

The Fifth
Essay of D.M.

A Friend of Truth and Physick,
Against the
Circulation of the Blood.
Shewing its
Absurdity & Impossibility;

AND THE
Cause of Pulsation;
AND OF

The Motion is seen by means of the
Microscopes in the Blood, and its Vessels.

Ovid. Metamorph.

*juvat ire per alta
Astra; juvat, terris & inani sede relicta;
Nube vebi: cœloque sedens imminatus, ab alto
Palantes homines passim ac rationis egentes
Despectare procul.*

By
Oliver
Hill.

Prov. 17. 24. Eccl. 2. 14.

The Wise Man's Eyes are in his Head; but the Eyes of the Fool
are at the ends of the Earth.

LONDON: Printed for Edward Everett, at the Green
Dragon in St. Paul's Church-Yard; and also to be Sold
by all Bookellers in Town. 1733.

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To

The Fifth

ESSAY

OF THE

Non-Circulation of the BLOOD.

The Introduction.

*Ille Ego qui quondam Clerum confodere multis
Ausus sum telis; jam nunc foetentia pure
Arma ciere juvat Medicantis raro Cohortis.*

QUack and Clerk; Doctor, Bishop; *nullo discrimine habetur*, when *amica Veritas* is concerned: and therefore have at the Physicians now, as well as at those before derive their Name from that Trade which they call *Divinity*: and at their Master-piece too; the Circulation of the Blood; the most useful (if we will but take their word, and believe all that they say, without *looking well to it*, Prov. 14. 15.) of Modern Discoveries: without which no Man knew how to live in Health before them,

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them, if Health depends upon it, as from their Hypothesis it follows that it must do.

you'll say, A bold Man indeed!
O Disturber of the Peace and Quiet of Physicians!
Who lay Supine under a Notion by none attempted.

2. To which my Answer is, That tho' I am for Inventions and Improvements of Knowledge, yet being at the same time for old Truths and for old Ways, old Nature and the old World, against the Innovations which some Men would make in them, and against making new ones, and applauding new Whymfies, except when good for something; I dare here attempt this in behalf of the Ancients: for I am of Opinion, that both Nature and Knowledge being the same in old Times as they are in our Days, (and Knowledge being God's Gift, he always distributes it impartially to good Men) all they that had it of old, saw as far as we by it into Nature and the Wold, and were as able, and better to find Truth by it than we; as more in the way to it, because less prejudiced, and taking a better Course than we to find Knowledge by; seeking it a *Priori* by the Reason and Causes, then looking on the Effects, to confirm their Theory: whereas the Modern Sages seek a *Posteriori*, looking first on the Effects or Experiments they make, and then deducing from them the Cause which they made them for, and which they had in their Eye: for Instance, in our Case, where the Motion of the Blood is the thing they look into, and make their Tryals to prove, without regard to the Cause efficient of that Motion.

3. I am for a Theory confirmed by Experience, but not for framing of one by Experiments only, especially in Physick, which depends upon Principles invisible and spiritual, to wit, the Spirits themselves, less obvious to the Senses than to the Understanding; and in such Point as this, where the very Source of Life, *viz.* the Heart and its Motion, is the main Thing in question. *Experimentum fallax, Judicium difficile* to the great Masters themselves who knew things *a Priori*, such as was Hippocrates; and much more to their Scholars, that neither know nor will learn; and who, looking no further and higher than the Effects, are apt to mistake the Cause, and to conclude on Mistakes, taking what they find and see for what they seek and would see; just like those that make the *Bible* to say as they would have it, instead of examining their Opinion by the *Bible*

4. Invention is a great thing, because *there is nothing new to be found under the Sun*, Eccl. 1. 9. and they that are so happy as to light upon new things Beneficial to Mankind, very well deserve a Name, which I would have no hand in taking away from them. For being of Opinion, that out of the same Motive as put *Luther* upon that which they call *Reformation*, that is, out of Contention; and because Man would be wise and singular in something to be taken notice of, *Job 11. 12. Prov. 13. 10.* some Modern Reformators and Improvers of Knowledge affect to be Inventors; I must beg their Pardon, if I applaud them not in every Invention, and if I make bold here to question the Truth of this.

Quicquid id est timeo Medicos Inventa ferentes.

5. And justly might others have the same Opinion of me, for offering at a thing is so well established, if I did not stand here for old things, and for old Men long since Dead, against the new; at whose hands I expect; instead of Fame and Applause, the same as he that pulls down an old House about his Ears may promise himself from it, for his Labour and his Pains; and who will own this is Truth, when the World prefers the Light to Darkness and Ignorance, *John* 3. 19. and *Wisdom is justified by others than her Children*, *Mat.* 11. 12. He that knows more than others, and shews it, gets more Envy than Thanks, or Favour, or Fame, *Ecc.* 9. 11. especially when none but the Fautors and Abettors of the Error he refutes are to be, as in this case, his Jury and his Judges. In short, *he that encreaseth Knowledge, encreaseth Sorrow*, *Ch.* 1. 18.

6. One Reason, I suppose, why this Invention of theirs hath so far prevailed with most Men in so short a time, is, that it being absurd, it agrees best with the World. Another, that Men will take for granted what they are told, rather than to go to see. And when things are intricate and deep, as this, which depends of the Knowledge of Nature, and of Life, Heat and Motion; and is of so large extent, that those few, which have a Head capable, have not time enough to search in, and sum up all that it is related to, and pass their Judgment on it; they do like the Leopard, which lets go what he cannot catch at second or third leap; that is, they let them alone, and will not be at the trouble of searching them out thoroughly; so that none going about to oppose such new Notion it passeth uncontrouled, *cum omnibus reliquis mundi erroribus*, and so

so becomes currant, espoused by as many as would seem as quick-sighted as the rest.

7. That the Knowledge of this thing is abstruse and difficult to be attained unto, Doctor *Harvey* shews himself, saying in his first Chapter, That he did almost believe it was known to God only; and was so troubled in Mind after a long Enquiry, by reason of the quickness of the Motion, appearing like Lightning on a sudden, which hindered him to discern which way the Diaſtole and Syſtole came to be, and when and where they begun, that he knew not what to think, and what to resolve upon; nor how to believe others in so arduous a case. The Syſtole appearing, adds he, sometimes from this place, and the Diaſtole from that, and sometimes just contrary; and sometimes the Motion was so various and confused, that he could conclude nothing. And Doctor *de Buck*, his Friend, and a Friend of his Notion, finding the same thing as he, saith, The Motion of the Heart was not yet thoroughly searched. Doctor *Lower* adds to this, That to know of its Motion, being God's Prerogative, the Apprehension thereof was a thing too high for him: at the 85th Page of his *Treatise of the Heart*.

8. How they came to extricate themselves from this Labyrinth, is what *Harvey* declares not, but saith only, He believed that he had done it at last. His great Eagerness to find, or to be an Inventor, making him so fond of what help'd forwards his Invention, and unwilling to bawke it, that he dash't out of his mind all the Considerations which might occur, and rise Scruples and Objections against it. But if he had considered, that it is no more possible to come at the Heart, to see its Functions and its Working whilst Life is in its full force, and able to perform

perform them, than at the Orbe of the Sun, to see the Light spring therein; because its Motion must be not only interrupted and confused, as he saith, but sometimes faint, sometimes strong, and violent and forced, and wholly unnatural when they cut open the Breast and the *Pericardium*, and other Parts and Vessels about it, to come at it, to see it and to feel it, and thrust their Fingers in it; he had not, I believe, been so nimble at *Believing*, and crying a *Εὐενηα* upon such uncertain Grounds as the Experiments made at such time stand upon; but had despaired as much as at first of finishing by their means his Invention, and of being the Author of a new Hypothesis.

9. If but pricking, nay, touching of the Heart or its pieces, when taken out and cut small, and the pieces having been lying still a pretty while, and their Life as good as gone, sets them in motion again, and beating, as *Waleus* and *Harvey* confess they do, into what a violent and unnatural Motion must the tying of a Dog, or of a Sheep, for Instance, by the four Legs stretcht out; and cutting open his Breast, and his Heart off with the Veins and Arteries about it; set his Heart before they can come at it to see it move; every body may judge who hath taken notice of the Effect, the fear alone of being beaten or hurt worketh in a Dog, who trembles at the very Threats of it; and of that the Pangs of Death work in a Sheep or a Pig, which voideth his Excrements both ways when they cut his Throat. If the retentive Powers be so much out of order at that time in the Bladder, which is the Extremity, as to let go what it held and would have held in longer; how can they be otherwise in the Centre, or the Heart which Life it self derives from,

from, and perform Actions duly in the part is set upon, when they cannot perform them in those are not affected? and the Expulsive may then cease to to act their part likewise, that is to say, cease to keep off Blood from the left Ventricle, and to deny it Entrance, as it will be seen in time, the Spirits that rise in it and blow the Blood off of it, do whilst Life and Health endure. And no great wonder therefore if being then distracted, and in a hurly burly, they give the Blood Admittance; and if when it is let in, they muster up all their Force and Posse to let it out again, and sling it away through any Wound or Hole made in the Substance of the Heart, as far as *Waleus* saith, three or four Foot, or more, to help Life at a dead List; or to turn out of the place the Blood which, if suffer'd there, would doubtless suffocate it, and put out the Light of Life which breaks out in that Ventricle, whilst Life it self continueth.

10. So that it appearing hence how uncertain and doubtful the Judgements they pass upon the Observations they make in all such Dissections, tho' of living Animals, must of necessity be, we may judge and see how far the Conclusions built upon those Judgements, are like to hold; and how much we may depend upon them, and trust to them. And we may draw from the same a Conclusion contrary to that of Doctor *Harvey*; that we are as far to seek in the Motion of the Heart, notwithstanding their Tryals, as ever we were before he concluded upon them. And to conclude this Proem, with the words of a Great Man, as wise as Doctor *Harvey*: I say as I said, *Experimentum fallax, in the best Experiments multum imperitiæ peritiâ ipsa præstat.*

The First Chapter.

The Reasons of the Author's Dissent, and what he approves and disproves of this Notion.

1. **N**OW my speaking so of their Tryals and Experiments, tends not to invalidate the Reality thereof, nor their Skill in making them; but the Conclusions only, and Judgements made upon them; for all of them together amount not to a full proof of what they deduce from them, to wit, a Circulation of the Blood; and its being driven through the whole Body from one Ear and one Ventricle of the Heart to another; and to a Demonstration of the Hearts distinct Motion, or beating by Intervals; and of that nothing but Blood passeth away from the Heart when it dilates and contracts; all amounting to no more than shewing of a Motion in the Blood, which all Men grant, not one of the Blood it self, which is a dead passive thing, nor of the thing moves the Heart and the Blood by Intervals; for Doctor *Lower* himself, after all his apparatus and long Series of Notions, to make a Muscle of the Heart, confesseth his Ignorance of this last Point, to wit, *pag. 85. of his Treatise of the Heart*, and answers nothing at all to the Objections made him, that a Muscle is an Organ of voluntary Motion, the Heart moving even whilst we are not willing

willing it should, and so cannot be a Muscle: and as for Doctor *Harvey*, he doth as good as confess, *viz.* in the Experiment made of a streight Ligature turned to a middle one, in his 11. Chapter and at page 66. that something besides the Blood passeth away from the Heart, which occasions, or at least contributes to its Motion.

2. And really I am so far from thinking their Tryals false, that I make use of them my self against their Notions, and allow of what they shew, *viz.* a Motion in the Blood, and a progressive Motion from the Heart, where it begins (for it is the first Mover) through the Arteries and Veins to all parts of the Body as far as the Veins extend; and a filling and emptying of the Heart every Pulse; and that the *Vena Cava* and *Vena Arteriosa* convey Blood into the Heart, and into the Lungs also; and that the Blood which this last receives from the right Ventricle, may well find its way and pass through the Streiner of the Lungs; and that upon the binding of the Venous Artery, it doth swell towards the Lungs and empty towards the Heart, and in fine, of all that which is shewed by the Ligatures.

3. But a Motion of the Blood it self, and such Motion as they say, *viz.* circular, and in such quantity as amounts to six times more than the whole Mass of the Blood, that is, to near six score Pounds every hour of the day; and Blood in both the Ventricles; and the Passage of so much through the Streiner of the Lungs; and that nothing else than Blood passeth away from the Heart into the great Artery, and upon its Contraction or its Systole only; and that the Blood is the thing which worketh all the Effects which they do ascribe to it, is what I here gainsay; because all they say for Blood, may
by

by far better Reasons, as shall be shewed hereafter be concluded of Spirits ; and because the left Ventricle cannot suffer any Blood or any Liquor in it, and the Lungs cannot transmit such quantity of Blood through themselves or their Substance, and the Venous Artery suck it up again so fast into all its small Branches ; but the Lungs must be bloody, as the Liver and the Flesh, and more too ; which we don't see : and because this circular Motion were to no purpose, and without necessity ; and that they can shew NO Cause efficient of this Effect, all those they have assigned hitherto being not able to produce one half of it, and having for the most part no Existence in Nature. And, in fine, because we can shew them an adequate Cause of the whole *Phanomenon*, which answers every thing, and which is more natural, or according to Nature, than are all the far fetched and forced Reasons they give and invent for their Notion ; and however not so much as it against common Sense ; of all which in time and place.

The Second Chapter.

An Account of the Modern and Ancient Hypothesis ; and of the difference between one and the other.

- I. **A**ND to make things the plainer to those who are not throughly acquainted with this

this matter, and have not time to consult the Books of Anatomy ; before I go further, I think fit to give here a rough draught of the Ancient and the Modern Opinion : that every one that reads may carry along with him a general Idea of both Notions together, and so apply the better what he reads to its due place, and compare things together, and judge of them, and come to some conclusion of himself, upon reading of the whole ; which is the end of reading, and of writing of Books. And such are to take notice, That there are four Vessels coming out, or inserted in the Heart, no matter which ; through which all that doth go in or out of it must needs pass ; two Veins and two Arteries ; viz. out of the Right Ventricle *Vena Cava* bringing in, and the Arterial Vein carrying Blood out of it ; and *Arteria Magna*, and the Venous Artery bringing in, and carrying Spirits and Blood from the Left.

2. First, the Ancient Opinion, which I own myself, is, that the Blood moves not it self of it self, nor Circulates ; but that that portion of it which is made every day from the Chylus, and the Victuals, goeth from the *Vena Porta* through the Liver, and *Vena Cava*, into the right Ear, and right Ventricle of the Heart ; thence into the whole Body, through *Arteria Venosa*, or what other way you please, (for it is not my business to find out a way for it) except through the left Ventricle, into which, that which recurs from the Lungs doth not enter ; and there, in the Parts, it stays, and taking up its quarters in the same, goeth no further, and returns not to the Heart. In the mean while part of the *pura abundantia ex secretion sanguinis orta*, as saith Great Hippocrates, *de Corde* ; that is, of that Blood which comes from the Chylus, through *Vena Cava*

Cava to the right Ventricle, & *radios immittens*, through the holes in the *Septum*, which are made for that purpose; *Alimentum suppetit & distribuit*, adds he, *sinistro*; that is, Spirits, for the Aliment, saith he, doth not become Aliment till it becomes a Spirit; and these Spirits joining there, with those that come from the Air, which the Heart draws through the Lungs, and the Venous Artery, they kindle in that left Ventricle the Light and Fire of Life; and feed it by breaking out from time to time into Flames, or into the flash of Life, and sending forth a Spirit (made then Vital, but being but Natural in the right) which swells and distends the Heart; and in its dilatation (which is its *Diastole*) thrusts open the *Valvule* (*intus foras spectantes* for this very same purpose) of *Arteria Magna*, and pass away into it, and into other small ones; with some part of that Blood which lays, saith *Harvey*, in great store and abundance in the Ears. Upon which the Heart subsides, and comes to its *Systole* as fast as the said Spirits pass out and evaporate. And so passing, and beating, or making a Pulsation every time it dilates. This, whether the Ancients did make the thing so plain or not, is the Opinion we take upon us here to maintain.

2. The Modern Opinion is, That the Ears contract themselves, and throw in that contraction, the Blood which they abound with, *as the head Springs of the Veins, and the Cellar and Cistern of Blood*, saith Doctor *Harvey*, in their respective Ventricles: Which being filled with it, by the stretching of their Nerves (as Doctor *Lower* calls them, though they are properly but *omnis generis fibra*) they, and the whole Heart dilates upon this filling with Blood: then straightways when they are full, pulling

ling in their Nerves again, and contracting of themselves, they press out, by expulsion, the Blood they had received and taken in from the Ears, upon which the Heart contracts, and maketh a Pulsation; by which Pulsation it thrusts and drives the Blood from one Ear, and from the great Artery through the small ones, and the Veins, into the *Vena Cava* again, and the other Ear: where joining with the new Blood daily made from the Chylus, it returns into the Lungs through the Arterial Vein; and losing it self therein, and streining through their substance, as some Rivers in *Africk*, and in *Spain*, do in quick Sands, it is suck'd up out of it by the Venous Artery, where reuniting it self, it runs together again into one Head, and one Stream, and breaks out like a Torrent into the left Ear again, and into the left Ventricle; and so round continually, galloping in great post haste, (to do what no Body knows,) to the quantity of more than two thousand pounds a day; which is as much as would run out of a Pipe of about a quarter of an Inch bore. This is the State and Account of their Opinion and mine. And if they find any thing is wanting to this Account, let them supply it themselves; for the truth is, this Notion is so far from being brought by them to its perfection, that they are not yet so much as agreed on the main thing, to wit, the cause efficient of the motion of the Heart; each offering a new one, and finding fault with the old: And the last to stop the holes which the first have left open, denying what these affirm: and all say so many things which are Contradictory, as by the Contents of the sixth Chapter it will appear, that it is no easie task to reduce them to a Head.

4. The Difference between us, and the Mistake

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or

of one side, consisteth especially in that one side affirms that there is Blood in both Ventricles, the other in one only; one saith that nothing but Blood passeth away from the Heart, and the other adds Spirits; one that such quantity of Blood passeth through the Lungs and Portals, or *Valvula* of *Arteria Venosa* and *Arteria Magna*, which neither of them can hold, or however, can transmit; the other is for no more than that which is daily made, which the Lungs and *Valvula* can well contain and admit: one that the Heart expels Blood, and drives it through all the Veins by a Force and Faculty the other shews it hath not, and which would not be capable of driving it at the rate which they say, tho' it had it: one that both Ventricles expel and drive Blood at the same time, and contribute together to the Dilatation or *Diastole* of the Heart; and that the Motion of it cometh from its Contraction, the *Diastole* being but a Return of the Heart to its State, or a *Motus Restitutionis* only: whereas the other denys those three things altogether, and saith the Blood is sucked up by the Venous Artery and the Lungs (when they dilate) from the right Ear of the Heart, so that it needs not expel any Blood from that Ventricle; that the swelling of the Heart comes but from the left Ventricle, which is placed in the middle, the Heart seeming to be made wholly for it, as *Harvey* himself grants and confesseth in his 17 *chap. pag. 95.* and that its Motion is both a rising and a falling, to which end Fibres may serve, without making Nerves of them with Learned Doctor *Lower*: which Fibers stretch and relaxe whilst the Flash is a rising and distending of the Heart, and whilst the Spirits which flow from the Flash or Flame in it are a passing out of it into the great Artery. And there
being

being in the right no light, Flame, or Flash of Life, and no Spirits proceeding from that Light to pass away, there is no such Expulsion nor Dilatation in it or from it, as in the left. And if the Reader will judge as he shall read and go on, he will easily discern on which side the Mistake lyes.

The Third Chapter.

The chief Ground of the Mistake, and the way which the Author will take to rectify it.

I. **B**UT the Dispute ariseth chiefly from this their Mistake, to wit, that in Dissection finding Blood in both Ventricles, they think it is always there as well when the life prevails, as when it is overcome: and seeing that the Blood moves; and that something doth always pass into it from the Heart, they think that the same is Blood; and that there is nothing else passing with it and moving; and so conclude with *Harvey*, that this Blood being sent forth in far greater quantity than the Aliments produce, and then is wasted and spent in nourishing of the Parts, it must needs return again, and go round continually, lest it should, like *Euripus*, ebb and flow, dance up and down, and weary it self in vain: But, if I shew fully, (1.) That the Motion in the Blood is not from the Blood it self, nor from the Heart, either by the expulsive Faculty, all of them ascribe to it; or by its being a Muscle, as *Dr. Willis*, *Lower*, and some others will have it. (2.) That they are Spirits,

not Blood, which pass away from the Heart at every Pulsation: the Heart containing no Blood at all in the left Ventricle whilst the Body is in Health; and therefore sending forth none. (3.) That there is no efficient nor final Cause of the Blood circulating at their rate: and *lastly*, If I shew an adequate Cause for all the Phenomenon can shew, that will answer not only to a Motion in the Blood, (which is all their Cause can do) but to the distinct Motion of the Heart by Intervals, (which their Causes cannot do.) I hope, or however have Ground to hope, I say, that every Man of Parts will grant that their Conclusion, and the whole Hypothesis it self is quite out of doors.

2. And without going further, common Sense it self, without the help of Experiments or Authority, shews them, that since all Motion ceaseth in the Heart, and in the Blood, as soon as the Body dies, and lasteth but during Life, they do not move of themselves, but by that which comes with Life, and goeth away when we Die, to wit, the Vital Spirits, which the Blood doth abound with; and which arise in the Heart, and go from it to the Head, and into the Blood also directly at the same time, without rising to the Head; and returning down from it. We have the Authority of *Hippocrates*, *Galen*, *Foefius*, and many more, for the Coldness of the Blood, and its Incapacity therefore of Heat and Motion, but by accident, from that which Heat and Motion come from. *Sanguis*, saith *Hippocrates* in *Libello de Corde*, *non calidus natura sua, sed calefcit*. *Galen* in *lib. primo Salub.* saith, *The Blood hath much of both the earthy and watry Substance in it, therefore is cold of it self*, and so moves not of it self, for all Motion goeth with Heat; and it hath

hath neither Motion nor Heat in a dead Body, but grows cold and stands still there; whereas it is hot, and thin, and moveable in living things, *per Accidens*, saith *Foesius*; *Præter naturam suam*, saith again the same *Galen lib. de Tumoribus, quod beneficio Spirituum incalascet, Et eorum impetu motuque agitetur*: all Motion, as I said, and Impetuosity in the World coming from them, and that of the Blood therefore, and of the Heart and the Parts; as by Experiments drawn from the Inventors themselves shall be made out in the next.

3. *Harvey, Walæus, Willis*, and all but Doctor *de Back*, own these Spirits in the Blood, whither they go from the Heart; for from whence can they come else, since the Blood is of it self a cold and congealed thing, which having them not it self, cannot give or produce them? And it is strange these great Men, with all their Ingenious Tribe, should own Spirits in the Blood, and that the Heart and the Blood move but whilst Life subsisteth; and yet should take no notice of either Life or Spirits in treating of the Motion of the Blood and of the Heart: but fall straight upon the Parts, to wit, the Heart, and its Nerves, and the Blood and its Vessels, and catch hold, some of its Muscles, or its Musculosity; some of a force in the Blood from an imaginary Faculty of expelling in the Ventricles of the Heart; and some of any thing else, rather than have any thought or regard for that thing which they move by, to wit, Spirits: and should be so much in haste to vote for their Invention, and to ascribe to the Blood the swift violent Motion which they say it doth run with, as to over-see the Cause and Agent of all Motion and Impetuosity in the World, to wit, Spirits, which all *Impetus* comes

from; (whence *Hippocrates* calls them *Impetum facientes*) and never so much as ask these Questions, *Per quid, ad quid*; to what End, and by what Cause efficient the Blood should move and can move *in circulum* to the Quantity, and with the Swiftneſs they ſay it doth: and this whilſt they ſee themſelves ſuch other things in the Blood as are moſt evident Proofs, not only of the being of theſe Spirits in the Blood, but alſo of their being the true Cause of its Motion.

4. It is true, that both *Willis* and *Lower* allow of them, in making the Heart a Muſcle, and endeavouring to prove that it moves, as other Muſcles, by the animal Spirits: but theſe are in, and muſt come from the Head into the Blood; whereas they that move the Blood, being in the Blood it ſelf, and ariſing in the Heart, come from the Heart into it, and by no means from the Head; nay, ſupply the Head it ſelf, and the Brain with their Spirits, which become Animal there, that is to ſay, *fit to be Inſtrumenta Animæ*; Tools of the Will of the Soul. For the Heart doth, like the Sun, which ſends his Beams or Spirits upwards as well as downwards through the whole Circle of Heaven, ſupply the Brain and the Blood at once with the ſame Spirits; which in the Blood are Vital, and in the Brain Animal. This, I ſay, theſe great Men, being unwilling to ſee, take no notice that Spirits in the Heart and in the Blood are Vital, not Animal, (being (as they grant) to feed and convey Life to the Parts) and that the Blood is Vital but as being the Vehicle of the ſame Vital Spirits; and this their oversight is to the end they may deduce their Circulation, from thoſe that move the Muſcles and the Parts.

The Fourth Chapter.

Shews from the Authors themselves of the new Hypothesis, the Existence of Spirits in the Blood and its Vessels ; and a Motion of the Blood by their means independent of the Motion of the Heart.

NOW these Spirits, tho' the Cause of the Motion of all things, and consequently of that of the Blood and of the Heart, being not only taken no notice of by those Men, but their Existence being disputed by some of them, of the Corpuscular Tribe ; I think it convenient to shew here, that they exist in the Body and the Blood, and that they impel the Blood, and cause a Motion in it ; and to begin to shew this out of their own Authors first.

1. Great Doctor *Harvey* himself in his *Proem*, pag. 5. owns them to be in the Blood ; *No Man can deny*, saith he, *that the Blood, as Blood, and as it is flowing in the Veins, is both imbued with Spirits, and swells in the Arteries with a greater store of them than in the other Vessels.* And grants, that they are Vital and not Animal Spirits : saying pag. 51. *That all the Parts are quickened, nourished and cherished by the Blood being made warm, vaporous, full of Spirits ; and so alimentative.* Yet without considering whence they come into the Blood, and

what they have to do there; he drops them there, and goeth on in his way of Expulsion.

2. Doctor *Willis* not only confesseth them in the Blood, but allows a *Flammula* in every part of it; which is more than bare Spirits: for a *Flammula* implies both the Spirits which it is composed and formed of, and their kindling or breaking out into a flash or flame, which they never do but when they gather in quantity: and that in the left Ventricle, but not in the Blood at all: that Light which is in the Blood being but the Beams of that which flasheth out in the Heart, by a Coacervation of the Spirits in that part, as shall be shewed in its place; and thence disperseth again in the Blood and its Vessels, where therefore it can not shine.

3. The Spirits, saith *Walæus*, called Vital, by reason that they come out of the Heart, *cum Sanguine permisti*, move with the Blood, *eadem ratione moventur*, or the same way from the Heart. And therefore are in the Blood, since they move in and with it.

4. They grant all with one accord, that the Blood in the Vessels near the Heart is Spiritual, hotter, thinner and more full of Steams than that in the Veins which are more remote from it, and is made moveable by it. *Quod fit*, saith *Walæus*, *à spirituum majori minorive copia, prout magis minusve Sanguis a Corde distat. Spiritus Fluxionem atque motum exhibent*, saith another of their Tribe; perceiving that the Blood stands, and congealeth and grows cold when it hath lost its Spirits.

5. That the Vessels near the Heart pulse and beat, the others not; because those being nearer than these to the Seat of Life and the Store-house of Spirits, those become more exposed to their *Impetus* and Force, than

than these which are more remote, and receive a Force from them, I mean from the Spirits, capable to make them beat: which Force growing less and less, as it removes from the Heart, and comes to remoter parts, is too weak to make these beat, when it is come into them.

6. They grant, *Harvey* amongst them pag. 104 and 106, That the Reason the Tunics of the Arteries are thick, and stronger than in the Veins, is the same, viz. to resist the great Force and Violence they are more exposed to, than other remote Vessels; and to hold in the Spirits, that they may not sweat away, as they do through thinner Skins; and thereby may be convey'd as far as necessary. *Harvey* owns the Force of that Impulse, tho' he derives it from another thing than we; but as soon as it appears, that the Heart doth not expel, and that the Spirits, not Blood, is that which comes out of it, it will be clear that this Force proceedeth from the Spirits; and that Spirits exist there, and occasion that Motion.

7. That Air and Blood run and flow out of a cut Artery with a continual Motion; (it is *Harvey* that shews this pag. 3. of his *Proem*) and so are there together, or they could not both come out. Now, the Air being it self Spiritual, and a Spirit; or however the Vehicle of the Spirit of the World, which cometh down from Heaven: it is the same as to grant the Existence of Spirits in the Blood, or with the Blood.

8. That *Vena Cava* doth beat whilst the interjacent Veins, through which, according to them, Motion should come into it, and the Venous Artery it self, tho' an Artery and that brings Blood to the Heart as well as *Vena Cava*, do not beat, (*Harvey*
 hign-

himself saith so of that Artery pag. 104.) which shews that this Impulsion and Beating of the Cava comes not from that of the Blood, but from some other Agent, (to wit, the Spirits in it,) than in all the other Veins; which Spirits come into it from the Chylus and the Victuals, being more disligated and loosd from their Matter, and so acting more freely and powerfully in it than in the Vena Porta: whereas all the other Veins and the Venous Artery being remote from the Heart, and having not this supply of Spirits, cannot shew it by a Beating and Motion.

9. That the Veins and Arteries, when bound, swell to a Hardness, and feel hard in that Swelling, which cannot come from the Blood without the help of Spirits: *Non enim tendi possent in talem duritiem*, and especially upwards, as *Waleus* himself saith, *a tenui liquida Sanguinis materia, nisi a spiritibus sursum impelleretur*.

10. That the Veins cannot let out Blood without a Ligature, but the Arteries do it; because those have not Spirits in them enough to drive it; whereas these have a great many, which make out their way themselves in their progressive Motion from the Heart to other parts; and carry along with them their Vehicle, or impel it with Impetuosity, according to their nature, (which is *impetum faciens*) whence it gusheth and leaps out of any cut Artery without any Ligature. But the Blood in other Veins being not so Spiritual, cannot run out of it self; its few Spirits being not capable to impel it, except they be restrained, and by that Restraint gather and muster up Strength enough together to impel it. Whence, when a Vein is cut off, it shrinks in and the Blood stops; whereas in an Artery it happens

pens quite otherwise, all the Blood in the Body running out when it is cut, in less than half an hours time: as *Harvey* saith pag. 57.

11. That by the Experiment pag. 66. of *Harvey*, of loosing the Ligature when the Arm is bound up streight, or, as he calls it, *changing it into a middle one*, they shew us the Existence and Motion of the Spirits in the Blood and Arteries, tho' unwilling to name it; his Observation being, *One might see the Heart and Blood (the Impediment, saith he, being as it were removed) enter in by Pulsation, and something breathed into the Hand from the Arteries, and dispersed all over that part immediately*, it being on a sudden heated and swelled by it. That something breathed into, and accompanied with Heat, what can it be but Spirits? for nothing can be breathed but a Breath or a Spirit; and the very heat denotes the Spirits there in Motion: and this sudden Intrusion and Heating is an Effect and Proof of their *Impetus*, and flashing out, as it were; the Blood being incapable of moving, and of heating, and causing such swelling without the said *Impetus* of the Spirits within it.

12. That the Heart being cut out of the Breast, and to pieces, it moves for an hour after distinctly, if it be whole: see *Harvey* pag. 61. but however a good while when it is cut to pieces, and the pieces beat and wriggle like the Flesh of a Viper which is dead alive and cut after all the Blood is gone, and when they have left beating, if they be gently warmed, they begin to beat again: which comes first, saith *Walens*, from that the Spirits therein, *a calore vegetiores facti melius ei cause possunt inservire quæ in Corde Pulsam facit*. Secondly, That *Spiritus in carne Cordis contentus & queritans exitum exemp-*
tar

tas & diffectas à Corde partes mover: whereby they own both Spirits and the Motion of the Heart by them, and not from the Blood, nor by its Nerves and Fibres; for being cut to pieces with the pieces of the Heart, how can they draw any more, and cause the Heart to contract?

13. That upon the *Systole* the Heart grows pale and whitish, but red and fiery again upon the *Dia-stole*; which comes not from the absence and the presence of the Blood, which *Harvey* derives it from; but from that of the Spirits which flash in the *Dia-stole*, and pervade every Pore; and then retire and pass away in the *Systole*, appearing there in the Heart, and disappearing again, as in the Lips in the Face, and in the privy Members in case of Fear, and Anger, and Shame; and Lust in the last. For tho' they commonly say, that the Blood flies in the Face when we Blush or grow Angry, yet it being a plain case that it is not Blood which makes the other red and fiery, for no Blood comes into it when it encreaseth in Bulk, but store of Spirits only; we may conclude the same thing of the Face and of the Heart; especially seeing that there is never the more Blood in any inflamed Part for its looking very red; nor the less in a pale Face, for its looking wan and pale: the Spirits and the Tincture in sound Blood being the cause of the Redness of the Face by their Irradiation. Neither can the Blood appear through the thick and massy sides of the Ventricles of the Heart, tho' never so full of it, as it doth through the thin Veins; which yet look blew, and not red: nor can the Blood penetrate so far into the Substance of the Heart as to be seen, and make it look red without; this penetrative Virtue belonging to the Spirits: where-
with

with the Blood boils and sparkles; and whereby *tota sua natura agitur*; saith the Prince of Physicians.

14. Add to this that by-saying pag. 74. That if in Phlebotomy any Passion of the Mind which causeth Fear and Swooning, intervene, the Blood will stop, and run out but drop by drop; they do tacitely confess that the Blood moves, goeth and stops, by the means of the Spirits; for how can any Passion of the Mind have an Impulse and Influence on the Blood and the Heart but by their means? as shall be shewed in answer to Doctor *de Back's* Reasons. And it is the Mind moved by the Imagination of that which she hopes or fears, that doth either strike a damp upon them, or stir them up: nor is the Blood susceptible of Fear and Sadness, or Joy. As the Blood leaps from the Heart and the Arteries, when cut, by the means of the Spirits, and moves by them in the Veins after the Heart is cut off and taken from the Body; so it is for want of them, or of their Function, therefore, that it stops its Course, and comes from the Veins but drop by drop.

15. And in fine, they confess all that the Parts grow lean, and cease to receive their Aliment when the Arteries are bound; *Inhibito aliquo modo per Ligaturam influxu Spirituum*, saith *Walaus*; the Spirits being their true Aliment: for *Alimentum non est tale*, saith Hippocrates, *antequam in tennes vapores convertatur*. And so it follows from hence, that as the want of Spirits is the cause of their Leanness, so the abundance of them is what makes them fat and plump. And this shews their Existence and their Motion from the Heart, through the Blood, into the Parts, to feed and to make them fat; all Fatness coming from them, as appears from that it yields a Flame, and burns all away, as all spiritual things do.

16. All

16. All these things, and many such, too long to be brought in here, which are Proofs and Arguments of Spirits in the Body, moving the Heart and the Blood, they see, I say, and own; nay, make use of them themselves in answer to Objections, and to prove their own Notions, (for they are all excerpted from *Waleus* and *Harvey*, and are their own Suggestions:) But it seems they are so fond of their darling Invention, that rather than to forego,

Quæ authoris tacitum pertentant gaudia pectus.

the hopes of being Authors, which so tickleth their Fancy; they shut their Eyes against them, and whilst they deny Motion, by taking away the true and the only Cause of it, they establish a new one which never was in Nature; and cry out an *Ergo* of a thing which exists but in their deluded Fancy. And without Cause efficient of their new-found Entity, they declare right or wrong for it; and right or wrong will make it out of the Blood and its Vessels, sticking there without further Enquiries; and without raising their Thoughts higher for the Cause of it, than what they can feel and touch, they conclude as Children do, that the Blood and the Heart move, because they see them moving; as if Life, Heat and Spirits, and all that they own themselves, were nothing to their Motion, and were not to be thought of, whilst they have the Cause of it under Consideration.

The Fifth Chapter.

*A further Proof of Spirits in the Blood,
and in the Heart, from others than
their Authors.*

HAVING shew'd from their Authors the Existence of Spirits in the Body and the Blood; and their Influence upon the Blood and all its Vessels; it will be necessary for the better convincing of those Men that know no more of these things than what they hear, to demonstrate those two things, by Reasons drawn from Nature, and from the Authority of others than their Authors.

1. And first, all Ancient Authors, and most of the Modern ones are unanimous in it: And *Moses*, one of the first, and who was a Scholar bred in the *Egyptian* Learning, and so knew what was Sense, faith, That God breathed into Man the Breath or Spirit of Life, and gave Life by that Spirit. *Gen.* 2. 7. which is called ever since, of all, the Spirit of Life. And faith further, That the Blood, (which according to *St. Johns* 1. Ep. 5. 8. being the third in order, answereth to Gods Spirit) is the Vehicle of the Life of Man, nay, the Life it self. *Gen.* 9. 5. as containing the Spirit that gives Life and maintains it.

2. And *St. Paul*, *St. James*, and Christ himself Teach, That the Spirits give Life and Motion, quicken, and keep the Body alive. *John* 6. 63. 2 *Cor.*

3. 6. all things dying without them, and falling into
decay

decay when they are bereft of them. *Jam.* 2. 26. *Pf.* 104. 29. 30. And the same with all Wise Men, make mention of the Spirit, and of the Soul and Body. *1 Thes.* 5. 23.

3. But supposing Christ, St. Paul, St. James, and Antiquity, and the Inventors themselves, understood not what they said, or Spake after the usual manner and common Notion, the last may see them themselves, and by their own Eyes convince themselves of their existence in the Blood and the Body, if they will but look upon the steams that rise from the Blood, and from their Legs and their Arms and their Hands when they are hot, and put them out of their Bed in the cold Air in Winter; those steams being but Spirits issuing and exhaling at the Pores with their moisture, which they never go without, but carry along with them, and turn it to a Vapor that they may raise it with them.

4. And if they will not believe that God breathed into Man the Breath or Spirit of Life, they may see we still breath it, and Live by breathing it in, and Dye without Remedy when we are kept from the Air and the Spirit it transmits; and as soon as we draw it no more in, or respire: And they may smell it besides, when let out at the back Door, or coming out at the Mouth of one hath a stinking Breath; and taste it and feel it too by its heat, and the swelling it produceth in the Veins, and its passage under their Fingers in the Arteries, and by eating things Toothsome and pleasant to their Palate.

Tanta enim omnibus Spiritus necessitas, ut si absque omnibus cibis per plures dies Vitam ducere possint, ipsis pereundum sit siquis Spiritus vias exiguo tempore in eos intercludat: Spiritum accipimus tam Ore quam Naribus, qui ad Cor delatus in sinistro illius Ventriculo

tulo majori quam in dextro assultu impetit et propulsat; unde non mirum est, continens Hippocrates, cum non nisi Spiritus et Aer in sinistro Cordis conceptaculo quidem contineatur, id esse a Natura solidius conditam, ut magis accommodum ad impetum ejusdem Spiritus sustinendum; atque calidi robur melius asservandum than the other, which being mollior & laxior, is fitter to contain Blood, as it doth; and is therefore called by Anatomists, which knew well the difference between them, Sanguineus.

5. And whatever they believe, it is certain, that the World, having its Being from God, who is a Spirit himself, *John 4. 24.* must be Spiritual also in its Birth and Beginning, and draw its Original from invisible Principles, that is to say, from Spirits; as the Heathen own themselves, amongst them *Lucretius*. And accordingly we read, That the Spirit of God was upon the face of the Deep; and rising from the Centre, where God was breathing it out towards the Circumference; not fluttering over it, as those that know little of God, and of his Works, translate it; for God is in the Centre, and the Centre of all things: and as he hath produced all the Worlds out of himself by the Virtue or Spirit, which issues always from him, *Psal. 23. 6. Luke 8. 46.* so he hath produced this from the Breath rising from him, as from the Centre, upwards. This Spirit thus infused from God into our World, is that which gives Life to it, and to all things within it; and is the *Cibus Vitæ* of all its living Creatures, as proceeding from the Mouth of that God, *Mat. 4. 4.* that *upholds them*, *Heb. 1. 3.* that is, gives them Sustenance. And it comes down from Heaven in the Air and the Water; whence it goeth into the

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Earth

Earth by its Chinks and Crevisses at the bottom of the Sea, with the Water its Vehicle, of which Minerals are made; and coming down from Heaven, it brings both Food and *Healing* to the Soul and the Body. The Spirit that heals the Soul, or brings it Health or *Healing*, being the Wings or Efflux of the Sun of Righteousness, *Mat.* 4. 2. and differing from that which comes from the Sun of this World, but in degrees of Pureness; this being mixt with Water; but this unmixt, pure and simple. That which was breathed in Man, *Gen.* 2. 7. being but the same with that which was breathed in the World, *ch.* 1, 2. and both these Spirits but one and the same Spirit of God.

6. The Steams rising from the Blood, and from the Limbs, when sweating, as it is said in the 3d Paragraph of this Chapter; and the very words themselves (which are the Work and Effects of the Spirit of the Heart sent forth, and beating the Air by the Agitation of the Tongue within the Mouth, as appears from that the Voice, is according to the Strength of the Body, high or low) are sufficient Proofs of the Existence of the Spirits within us the little World; as all fermented Spirits of Herbs, Corn, Sugar and Wine, made so subtil and refined by often rectifying or separating their Flegm, that when cast up in the Air, they will not fall down again, are the same in the great World. By their Heat, we can feel them when they come down from the Sun; and from the Fire or Heat of any living Creature. Every Candle burning and sending forth of its Rays, Inflammations and Swellings, Anger, and Blushing for Shame, and Lust burning in the Parts; all Odours, sweet and stinking, Exhalations and Vapours, Magnetisms and Sympathies; loss of
Strength

Strength by hard Labour, swooning Fits, the Palsy, Fear, which come for want of Spirits, proclaim all their Existence. And in fine, saith an Author, *In Physica & tota rerum natura Authores semper Spiritus allegandi; Vita Morbus, Sanitas, & totus visibilis mundus ab his regitur. Et nullam naturalis & præter naturalis actionis solidam causam reddere potes, nisi ex Spirituum esse seu Essentia.*

7. *Quere.* What is a Spirit? *Answer.* It is a Substance invifible, immaterial, incorporeal, and fimple and pure, or unmixt in God: but in the World, where it was at first mixed with Water, *Gen. 1. 2.* it is become a Concrete, and hath the three Dimensions which all other Bodies have. And in every Body it is a Spark of that which God infused in the World, and into *Adam's* Body; the Substance of Substances, that actuates all Substance, being that alone exists; for God, of whom that is said, *Exod. 3. 14.* is but a Spirit himself; and all other things vanish in a while, and disappear.

8. Of Spirit and of Water results Matter, Earth, Body; these three things being the same, produced by the same means, *viz.* by the Spirit turning the Water into Vapour; then, by working upon it, inspissating it to Oil; and concocting of that Oil, or that Sulphureity, by continuing to work and act longer upon it, into a Salt or Body; for *ejus opus totum cum toto compactum est*; which Salt is Earth, and Matter: saith Doctor *Hippocrates*, who makes Water and Fire, that is, Water and Spirit, (which he calls *αὐτὸς ἀπὸ τοῦ πυρός*, and saith, that *sicut ignis ex internis rerum Spiritibus elicitur, sic & ignis iterum in invisibiles Spiritus resolvitur*) the first Matter of the World. *Zeno* made God and Matter the two Principles of all things; which is very found Do-

Strine: for God being a Spirit, and this Spirit the Substance, and Ground, and Stock of all things, all things must proceed from it, and Water joined with it, (which is the other Principle) makes Matter, as I said: the Matter of all Bodies being a Concrete of both God and Water, at this rate. And the Truth is, that Nature is but God himself *Nascens*, or bringing forth of himself: God is not at all cut off, nor so far gone from his Works, as the Corpuscular Tribe, which are Heathen, imagine. *Aqua dicitur quasi à quâ fiunt omnia*: all things growing together out of it, and God's Spirit, working always upon it whilst in the form of Vapour, and giving it a closer or a more compact Texture.

9. Take May Dew which hath been long circulated in the Air, by rising and by falling often in a hot Summer; this Liquor so sublimed, which is as clear as Crystal, should have neither Salt nor Oil, yet in five Pounds of it it yields three Spoonfuls of Oil, (which burns like all other Oils) and a pretty deal of Salt, distilled in Ashes or Sand. Whence comes this Oil and this Salt in this circulated Dew, which by its Circulation should have left them both behind; but from the Spirit in it, that work't upon its Vehicle whilst in the form of Vapour; and thickened it by degrees to an Oil, and to a Salt: never found in Snow or Hail, tho' but a Vapour themselves contain'd in the Atmosphere, and congealed by the Cold; because being congealed, the Spirit they abound with, is bound up in them also, and so benumm'd by the Cold and astringent Quality that predominates in them: that it cannot work in them; and produce a Salt and Oil.

10. To conclude, they may gather from that there is neither Pulse nor Breath in any Creature but whilst they live and draw Breath, that the Breath which they draw in doth contribute to their Pulse and Motion, and is in them. Especially, seeing that we are refreshed by Sleep, and by taking Rest and Breath when we run fast or work hard; the Spirits which we had lost, and had within us therefore, being restored in Sleep, because we breath freely then, and suffer no loss of them, as we do when we work hard.

11. From these things, and the Roughness which is in the left Ventricle, (which is rougher than the right, being crumpled almost like *Arteria Aspera*) they may conclude upon Air and Spirits in that Ventricle; that Roughness being caused by the Air which we breath in, coming by puffs into it, and giving it that Figure whilst its Substance is tender; that Air making its Substance as it were to undulate and configurate it self, as Water doth when frozen whilst the Air agitates it: or it may proceed also from the flash rising in it by Puffs, and by Intervals, as shall be shewed hereafter. The Reason *Hippocrates* gives of this greater Roughness in the left than in the right, is, that the left *continet*, saith he, *ignem innatum*, & *ita est trabendi facultate preditum*; drawing the Air to feed it, as all other Fires do. Whereas the right being not the Seat of the innate Heat, *non multum a modum aerem ad se trahit*; *nec, quia imbecillus, cum assultu impetit*: and therefore remains smoother, like that of those Animals, which having no Lungs, breath not.

12. And likewise from that the Lungs keep Pace and Correspondence with the Ventricles of the Heart in their rising and falling; and are parted in the

middle by the *Mediaſtinum*, that like a double Bellows they may ſend out of both ſides to both Ventricles of the Heart, the Air they draw in by turns, to which end the *Valvula* of the Venous Artery, and of the Arterial Vein open and ſhut contrary; to wit, one towards the Lungs, the other towards the Heart, that theſe may ſhut and keep cloſe whilſt the other ſide opens; from the which Correſpondence and Adaptation of Parts, they may gather, I ſay, that the Air the Lungs draw in, is to be ſent to the Heart, to feed it and reſreſh it, and that the Heart moves by it, and ſends it into the Blood; and that the Heart and the Blood therefore have Spirits in them; all Air containing Spirits; and being, as hath been ſaid, the Vehicle of that Spirit which cometh down from Heaven, to the Center of the Sphere.

13. Well, what then? what are all theſe Preambles to the Buſineſs? Yes, they are, for they ſhew that there is a Spirit in Man, *Job* 32. 8. in his Heart and in his Blood; and that theſe Spirits being the Agent of all Motion, and the only thing that moves, you ſhould take notice of them in ſearching into the Cauſe of the Motion of the Blood, and raiſe your Mind and your Thoughts higher than the Heart it ſelf, and the Blood, and its Veſſels, (where you ſee the Motion is) in ſearching out that Motion: and Query within your ſelves, whether theſe Spirits might not have ſome Influence in it. For as tho' God had breathed no Spirits into the Deep when he created this World; and tho' we breathed none in, you run on with Expulſion, and expelling Faculties, by what, you know not your ſelves, as ſhall be ſhewed in its place: and as tho' there were nothing done by Spirits in Nature, you turn them out of Phyſick, (as others have done likewiſe of late in
Divinity,

Divinity ; so that now we may both live and be saved without them, contrary to the Scriptures) and build a whole Theory of Nature, not in the Air, for then it were pretty well, the Air being full of them; but upon nothing at all but *Chimeras* and Conceits. What a rare World should we have, if in creating of it, God had taken your Advice! And some of you have the Face to deny their Existence; nay, and on no better Ground than that they cannot see them in the Vessels when opened. As tho' they could see the Air when it tosseth up huge Ships, with the Waves they ride upon! and throws down Towers and Trees, pulling these up by the Roots! and the Souls of their Patients flying away when they die! This is the Philosophy of a certain *Dutch* Head-piece, called Doctor *James de Back*, and the Fruit he hath yielded to the Town of *Rotterdam*, for the Pensions they gave him, to teach to Philosophise. But yet which Doctor *Harvey* makes use of in his Proem, for an Argument against the Air passing to the Heart through the Venous Artery: as shall be said in the next.

14. You Heathen Philosophers, hear a wise Heathen speaking: *Id omne quod cælum & terram interjacet, spiritu refertum est: Idque hyemis & æstatis causa existit; per hyemem quidem condensatum & frigidum, per æstatem vero leve & tranquillum. Quin etiam Luna solis & astrorum viam Spiritus dirigit. Igni enim Spiritus nutrimentum præbet, eoque privatus ignis vivere non potest; atque adeo perennis solis cursus, aerem perennem & tenuem esse facit, Quin & in mari ipso Spiritus esse quandam communionem, inquit, natantibus in illo, cuius manifestum: sine spiritu enim nihil vivere potest. Et Luna in eo sedes est ac fundamentum; hicque terræ*
vehicu-

*vehiculum; neque quicquam spiritu est vacuum. For-
vis omnia plena. Atque hac quidem causa est cur
in omnibus aer tantum possit.* I hope there is more
Sense in this than in your Particles of Matter, Ma-
terialists.

'The Sixth Chapter.

The Lameness of the Reasons, Arguments and Conclusions of all the Circulators.

HAVING seen their Over-sights, or what they
have over-seen, in treating of the Motion of
the Heart and of the Blood, we will now, to give
a guess at what we are to expect from the rare Ge-
nius and Skill of our Circulators, see what it hath
produced in drawing Consequences, and making the
Conclusions, which their new Discovery and No-
tion is built upon. And we will begin by their
Ring-leader, *Harvey* himself: and by that which
hath been said of him in the last Chapter.

1. *First*, He saith in his Proem at the top of
pag. 10. these words; *Why, when we cut up Arteria
Venosa, can we find no Air nor Fumes, if Air and
Fumes go through it? Because they are invisible;
and tho' visible, were gone through, and did not
tarry within till your Eyes could perceive them; for,
pray, are they to be seen when they cause the Head
to ach, and the Tongue and Throat to swell? Fumes
or Smoak are but Spirits exhaling from some Mat-
ter, which hath not Moisture enough to make of
it a Vapour.*

2. And

2. And he saith in the same page, *If a Man cut the Wind-pipe of a Dog, being alive, and forcibly fill the Lungs with Air; then binding that Pipe, cut up the Breast; he shall find great store of Air in the Lungs, but none in the left Ventricle and the Venous Artery: therefore, saith he, if the Heart did either attract the Air, or the Lungs did pulse it through when the Body is alive, they should have done it much more in this same Experiment; and some Air would have been found in that Ventricle, &c.* Yes, if you had shut the Door, that is, the great Artery, by binding of it also: for if you can bottle up Air in a Vessel hath a crack, or is open at one end, you are a great *Apollo* above all your Companions: and if undigested Air was to be at any time admitted into the Heart! *Qua enim ratione, saith the Great Hippocrates, ventus & aer, cruda cum sint, in alimentum cedant?* And tho' the Air did not pass from the Lungs into the Heart so fast as into the Lungs, yet it doth not exclude that thin Breath which can't be withheld; and finds its way through the Pores of the Substance of the Lungs, when the Body is in Health; as well as the Blood it self to the Venous Artery. *Quandiu corpus Sanum est, est totum, saith my Master, pervium, & transpirabile, atque permeabile, spiritibus scilicet:* but not after it is dead: and blowing in of crude Air, is enough to constipe it.

3. In the same Proem he saith, (to shew that the *Diaστοle* of the Heart and Arteries cannot be at the same time) if the Heart and Arteries be distended together; how can these draw from the Heart, and the Heart expel and press the Blood out at the same time? *Answer,* And what needs one draw, if the other doth expel? and it expels the
better

better for their being distended : and if the Force of the Heart is able to drive the Blood, as you say, from place to place ; I see no Reason why the Arteries should not be always full and distended ? and what Occasion they have to come to a *Systole*.

4. By his own Hypothesis both the Ventricles expel Blood, and both thrust and expel it by their Beating and Motion : and pag. 40. he saith, that the *Heart brings forth the Blood out of the Vena Cava by the drawing*, they are his own words, *of both its Ventricles* : and so by its *Pulsation, and its Beating and Motion brings it forth and transfuseth it from the Vena Cava into the great Artery* ; which is a peculiar way to draw by beating about ; besides the Contradiction of drawing and expelling by one and the same Action.

5. In the same Proem he saith, that the Constitution of both Ventricles are alike, that both serve for the same Use, *viz.* to expel and receive, *are almost all together*, both after the same manner in their Form and Position, and their Parts, Vessels, Portals, Ears, Fibers, framed alike ; and both of them equally full of Blood in Dissection. But pag. 95, 98. he saith, *That the left Ventricle being placed in the middle, possessing the middle of it, seems to make up the Heart of it self ; and by reason that it needs more Force to pursue the Blood further through the whole Body, it is stronger than the right ; hath a Wall three fold thicker, and Fibers stronger, and more in number than in the right ; and is fenced with higher Ditches, and in fine, framed with so much greater Diligence, that the Heart seems to have been made for the left Ventricles sake. Whereas the right doth not reach to the top, and is made up of a three times thinner Wall, and is more capacious*
for

for administering Matter and Nourishment to the left; is smother in its inside, and hath no Fibers at all, or else fewer and weaker; and seems, as it were, to be but a Servant to the left. How this agrees together, let the Circulators shew. The Truth is, the left Ventricle is round and wrinkled within, bossed on the *septum* side, or protuberating like the boss of a Buckler: but the other is oval and smooth, or smoother at least; concave on the *septum* side, and full of small holes in it, which go acuminating, and ending like a Funnel in the boss of the other, for transmitting into it the thin Vapours and Spirits extracted out of the Blood, which the right (witness Harvey just now) doth nourish him with, these holes being in the left so small, that they are not seen. Then the right Ear is larger, and of a looser Texture, and much softer than the left: and the Vessels coming out of the right, are two large Veins; and those come out of the left are two smaller Arteries. All which are strong Arguments of two different Uses; and proves, that *nullo modo*, according to my Master, *sunt inter se similes*.

6. He saith pag. 58. that in Anatomy a great deal of Blood is found always in the right Ventricle, but very little in the left: whereas pag. 8. he saith, that both are found full of Blood; and pag. 27. he found no Blood in either.

7. Pag. 3. of his Proem he saith, That in the *section* of an Artery the Air comes out of it with the Blood by a continual Motion; nay, and that Air, I add, sometimes blows out a Candle; but pag. 5. he teacheth, That Blood and Spirits make both but one and the same Body, as Whey and Butter in Milk, and that this Body is Blood it self, *and nothing but Blood*. Which if so, how comes that Air to be distinct

distinct from the Blood, and shew it self distinctly at its running out with it? and note, That what he calls Air in the Blood, is a Spirit; for crude and untemper'd Air is not suffered in the Blood, before it hath acquired the due Nature of Spirits.

8. He affirms pag. 30. That *the Ears abound with Blood, as the head Spring of the Veins, and the Cistern and Cellar of Blood, and that they give and supply the two Ventricles with it.* But pag. 96 and 107 he saith, *That the Heart and its Ventricles are the Well-spring, the Store-house, Fountain and Cellar of Blood; tho' supplied with it themselves from the Ears.* Now, which of them is the Fountain it springs from?

9. He saith pag. 48. That wise Nature was forced to add a *second Ventricle to force the Blood through the Lungs out of the Vena Cava, because she desireth that it should be streined through them; yet without shewing for what Nature should desire it, and by what the Heart expels, and from whence it comes to have an expulsive Faculty.* But this, tho' *gratis dictum*, is enough to serve their turn. Many other things want proof, which are taken for granted, because alledged by them: as that of nothing but Blood passing away from the Heart: and that whilst Life is in force, there is Blood in both Ventricles.

10. He concludes, that the Vessels and the Heart swell to Hardness, because they fill up with Blood. But *Walens*, the other great Prop of this Invention, saith this hard Swelling is *a vehementia motus, quæ spiritu venit.*

11. He and *Walens* assert a stronger impulse of Blood, and a greater Expulsion of it from the left Ventricle than from the other: see pag. 106. of *Harvey*:

vey : yet he saith in the next page, That the Arterious Vein hath a wider Orifice than the Venous Artery, *to carry more Blood than it*, as if, according to him, *Arteria Venosa* were not to bring back the same in the self-same space of time ; and if a Stoppage of Blood, or of the Motion of it, would not ensue and happen by that Inequality, in case of Circulation. And why is the right Ventricle supplied from larger Vessels, and the left from smaller ones, if the left doth expel more, or both expel equally ?

12. And he, with all the rest, saith, That the Blood doth circulate or go often through the Heart, to condense and rarefy ; *ut per eam frequentem rarefactionem & condensationem, ad generationem spirituum vitalium sanguis aptior fiat*. Whereas *aspirantibus ipsis jam generatis sanguis rarefcit ipse* : as they confess, see § 4. of ch. 4. A pardonable Mistake, forsooth, in Philosophers, to make the Effect the Cause, and to send Blood to the Heart for Heat and Rarefaction ; when one of them saith the Heart borrows his Heat from the Blood, and not the Blood from the Heart. Doctor *Willis* is the Man hath found out this new Reason.

13. They say the Blood is expelled because it is offensive and troublesome to the Heart after it hath been alter'd, or made hot and thin by it ; whereas to the contrary it is not fit for the Heart, nor for any other part, before it is hot and thin : for *alimentum non est alimentum* before that it becomes a thin Vapour. And if grievous to the Heart, why do they make it to be its Store-house, and its Cistern ? and fill both Ventricles with it ?

14. They say a Suffocation of *calidum innatum*, or innate heat of the Parts, and a Gangren thereupon

on may happen, as it is true, by the Blood running in them when they are bound up too streight. But whilst they fill up the Heart, and both its Ventricles with Blood; and especially the left, which is the Seat of that Heat, they are not at all afraid of that Inconveniency; nor of another greater; to wit, of Suffocating the Light and the Flame of Life it self, which springs in the left.

15. They alledge for their reason, why the Arm, when bound up so that the Arteries may beat, doth not swell to a great bulk towards the Hand, by the Blood continuing its Circuit, and returning from the Hand; that it is because the Blood can return *per latebras & cuniculos quosdam qui sunt sub ligatura*. Whereas they might rather say, that if it cannot go through those streight chinks in its return, it doth it not in going, and so doth not go thither, and occasions no swelling. And that the Spirits which are the cause of all those swellings (as they acknowledge themselves, *ch. 4. §. 9.*) being fitter than the Blood to go through those Passages, may go in and out through them; as they do; which is the cause that *ad plures menses annos ve pars constricta*, may be fed and nourished: the reason *Walens* gives of this, being frivolous.

16. They say one of the causes of the motion of the Blood is its weight or gravity. Whereas its moving upwards by the ascending branches cannot proceed from that Cause. But they did not think of this, because *Bonus homerus jam non dormitat* sometimes, but is now always asleep. It may be they think the Blood grows lighter when it ascends; and changeth its Qualities as fast as it shifts places.

17. *Willis*

17. Willis saith, pag. 51. of his kindling of the Blood, *Quod cor asanguine & non sanguis a corde, calorem mutuatur.* Whereas the Blood being cold and without heat of it self, as hath been shewed from *Galen, Hippocrates, &c.* it can't give what it hath not; nor kindle or yield from it self Fewel for a *Flammula*. And Doctor *Lower* denies this *Flammula* in the Blood, pag. 163. of his Treatise of the Heart.

18. And saith, both in the same page, and in page 61. that tho' the Heart be a Muscle, *& motu animali tantum exerceatur, solummodo sanguinis circulationi inservire videtur; & ab hujus visceris motu circulatio dependere fatendum.* Now, the Heart being the Seat, and Centre, and Circle of Life, from which all Life flows and springs, if it hath no other Use than to circulate the Blood; Life, it seems, depends wholly upon this Circulation, and cannot be without it. But it subsists without it, as shall be shewed in the next chapter § 4. And if Life depends on it, how could any before them restore Health and preserve Life?

19. Doctor *Lower*, in his Tract pag. 81. asserts, That *Cordis Diastole libratu adeo vicibus non succedit nisi a sanguine in illud irruente:* and pag. 74. That the Motion of the Heart doth not depend on the Blood. But if the *Diastole*, which is the principal part of the Motion of the Heart, be from the Blood running in, its Motion depends on that, and so depends of the Blood. And I doubt the Doctor could no more reconcile this, than shew us from whence proceeds the heat which is in the Heart; from the Performance of which he hath excused himself, pag. 74. putting it upon *Willis*.

20. They

20. They grant, That the Heart it self, and the pieces cut from it, move and beat by their Spirits *exitum queritantes*, and that the Blood is more apt to move in the Arteries, because hotter and thinner than the other in the Veins; and all this from their Spirits; which the Heart and its pieces have, tho' out of the Body: and they will not allow this to their Heart, and to their Blood, whilst whole and in their Body. But casting their Eyes far off to t'other end of the Earth, and over-looking of that which is standing before them, they seek for the Cause of that Motion they see in the Blood, not only out of the Blood, but in things where it is not, and where it can never be.

21. One will have a *Flammula* in the Blood, the other not: one ascribes that to the Blood which the other grants is done and performed by Spirits: one admits the Existence of Spirits in the Body, and the other deny's it; and they contradict themselves; say, unsay, and take and leave; and after every one, and all have said what they can, they shew and make out no more than a Motion in the Blood, which no Man ever deny'd: but for a distinct Motion, by orderly Pulsation; nay, and a Motion it self of the Blood *in circulum*, *hoc nimis arduum est*, it is God's Prerogative, *de hoc quid concipere*. And many other such Scraps of their Learning and Wisdom might be pickt out of their Books, and produced against them; but these few are sufficient to give a true *Specimen* of what their Lyncean Eyes have spied out in this Matter; and of the Solidity of the Ground and Foundation of their Building and Structure.

The Seventh Chapter.

Arguments of the Author against the Circulation.

HAVING done with the Weakness of the Reasons they offer for Proofs of their Invention, and made Objections against the Particulars of it; I will here suggest some against it in general, to shew the Unlikelihood and Impossibility of the Invention it self.

1. *First*, They have not yet proved, that whilst Life is in its force, there is Blood in both Ventricles; nor that it is Blood only passeth away from the Heart; and till this appears fully, their Notion is not proved: and all their Reasons therefore standing upon no sure Ground, are far from Demonstrations; and but lip Labour, or Talk.

2. All their Arguments prove but a bare Motion of the Blood, and a Dilatation and Pulsation of the Heart; but for its pulsing always orderly by Intervals, they freely confess themselves, that they are not quick-sighted enough to dive into it. So that their Discovery being but of a thing which was known to every Man, and denied by no body, is in Reality but much ado about nothing.

3. Cutting the Arterial Vein, and Syringing some hot Blood through the same into the Lungs, none of that Blood will be found in the Venous Artery; nay, nor in the Lungs themselves in passing through their Substance, as they say it ought to do. And if all the Blood they say should pass, in circulating,
D
through

through the Streiner of the Lungs, their Substance would be at least as bloody as the Liver, or any part of the Flesh: but we see it is not so, and no Blood is found in it after Syringing of it: therefore it doth not appear that any Blood goeth through it: and so their Circulation must stop and stay there a while, till they find another way for it than that is. If they say that this happens by the Reason I give against the Air Syringed in the foregoing Chapter, because the Lungs after Death ceasing to be pervious, admit neither Air nor Blood; I answer, however, this Experiment of mine stands upon the same Reasons, and is as valid as theirs, and more too, because the Blood being not Syringed cold, is not so apt to constrict the Lungs as their cold Air was.

4. They say the Blood circulates to convey Life to the Parts; if so, the Life of the Parts, and that of the whole Body, which is made up of the Parts, doth consequently depend upon that Circulation, and can't subsist without it. But we see the contrary; for when both Legs are cut off, and even above the Knees, we see Life and Health subsist, for all the remaining parts look fresh, and are in good case; and yet the Circulation ceaseth then; as it appears from that the descending Veins and Arteries are cut off, and closed up at the end by the healing of the Part; and keep at the same distance from the ascending Vessels as before they were cut off; so that the Blood can neither go down further through the one, nor return through the other: and it hath happened sometimes, that in a mortified Limb, not a drop of Blood came out of the Artery it self, when that Member was cut off. You say, that it doth return through the interjacent Flesh and the Anastomoses: in which case it must work out its way,
first

first through the Tunicles of the descending Vessels; then through the adjacent Flesh; and thirdly, through the Tunicles of the other ascending Vessels, to get into them: which would require more time than the Parts could allow of, and the Life could dispense with; because the Patient being in a Fever all that time, his Life could not struggle so long with the want of Nourishment, and the force of the Disease preying upon its Vitals. And supposing that the Blood could run through the thick and strong Tunicles of the Arteries, (when thinner Spirits themselves, as was said, cannot do it) it must come into the Flesh as hot and full of Spirits as the Arterial Blood is, and there cause the same Symptoms as when the Spirits break loose, and gather into some Parts, such as Inflammations are; which have never been seen there upon cutting off the Leg. So that neither loss of Life nor these Accidents happening when the two Legs are cut off, and Circulation ceasing, Life can subsist without it, and doth not depend of it; and it doth not convey Life, and is of no use to it; and so hath no existence in the Body and the Blood. As for Anastomoses to afford it presently a passage another way, is it what you ought to prove: for to say, that all the Blood finds its way in half an hour out of a cut Artery, is nothing to the Purpose; because in that case the Blood runs clear out of the Body, and must follow from all parts, as in a Crane or Syphon *propter fugam vacui*: but in this staying within and following each other, for the whole is in Motion, it can leave no space empty; so that there being in this no fear of a *vacuum*, as is in the other case, there is not the same Reason for the Blood forcing its way either forwards or backwards through

all chinks, to supply it. Moreover, half an hours time for the whole Mass of the Blood to run out of the Body, is four times longer than they allow for its running when it is circulating.

5. To this the Experiment in the 15th Paragraph of the precedent chapter, of the Arm being bound up, and yet the Hand not swelling by the abundance of Blood, which cannot return upwards because of the Ligature, may be subjoined, to shew, that the Blood keeps not running from the Arteries into the Veins; and forwards, or circulating about: but that it stays and remains in the Vessels where it lays.

6. If the Blood circulated, being as they say it is, the Aliment of the Parts, Life would subsist without Viſtuals so long as the World endures: for then it would, like the World, by the same means it useth, of circulating its Food or Aliment or Spirits from the Sun into all things, and from them into the Sun again, perennate it self; for the same Blood returning to the Heart continually, would feed it continually, without drawing from without, other Aliment or Food; as the Spirits enclosed in the World nourish the Sun without supply from abroad: and the Heart being supply'd, would send Supplies to the Parts, and so on continually to the end of the Chapter, so long as the World it self, from which it first received its Blood and Body, endures. For, pray, to what other end should the Blood thus circulate, than to that which the Spirits circulate for in the World? And if to the same Purpose, it must have the same effect: and so Life in Animals must still be re-producing, or perpetuating it self, without supply from the World. But we see it draws Supplies continually from without, and decays for want of them; so that having not its Food and Aliment

ment from its Sphere, it doth not circulate it; and so the Circulation of the Blood is to no end: or if it exist, it is as an *ens rationis vestra*, in your own Fancy.

7. And if it hath no final nor efficient Cause at all, it is no where in Nature: for nothing hath a Being without, *first*, some End and Use; for God doth nothing in vain, and multiplies not Entities without some necessity: and *secondly*, doth nothing without a Cause efficient capable to produce it. But you can assign neither, as shall be demonstrated; all those you have assigned being insignificant. So that *cessante causa, cessat effectus quoque*.

8. Whilst we live, there is no Blood at all in the left Ventricle; for there would be neither Heat nor Spirits in the Vessels, if both the Ventricles were full; because tho' the Spirits be generated from the Blood, it is not done but by Heat; and Heat is not producible but by a Fermentation or an Effervescency; which requireth, saith *Willis de Accensione Sanguinis*, pag. 52. a convenient empty space into which *Effluvia vaporosa, caloris suffocationem aliàs minantia, foras convehantur, & perpetim decedant*; which space it would have no where, if the Ventricles and Vessels annexed to them were full. *Secondly*, If there were Blood always in the left Ventricle, no Flammula, Light or Flash of Life would break out in it; for no Light ever breaks out where Humidity abounds; but where the Spirits prevail, and are sufficient to turn the Moisture into Vapour; and the prevalent Moisture would (as you confess yourselves, see the 14 parag. of the preceeding Chapter) suffocate the Heat and Flame which ariseth in the Heart. And so if there were no Heat nor Flame in the left Ventricle, there would be no Life in us,

for our Life is a Light and Fire flashing out there, from the Spirits and thin Steams meeting together in it, as shall be made out anon.

9. But that there is no such thing as Blood in the left Ventricle whilst Life is in its vigour; the Experiment describ'd in *Libello de Corde*, by *Hippocrates*, shews you: *Jugulati*, saith he there, *animalis aperto sinistro ventriculo, in totum solitudo apparet, praterquam serosi humoris alicujus*. Which Humour is but the Smoak or Vapour that makes the Flame, condensed into Water by the Suffocation of the Heat on a sudden. Doctor *Harvey* confessing less Blood in the left Ventricle than in the other, to wit, at pag. 58. nay, and none at all sometimes, at pag. 27. seems to acknowledge this Truth. And for a Groat you may have Hearts enough from the Poulterers, to try whether it be true: but they must be of such Fowls as have been suffocated, the word of *Hippocrates* being ἀποσφάγντος from ἀποσφάττω, to Strangle. And the Reason is, because in Death by Suffocation and Strangling, Motion ceaseth all over on a sudden, yet the Heart being the last mover, as *Harvey* himself argues pag. 58. and the Motion in the Blood ceasing before its Motion, the Blood stands still in its place whilst the Heart is still beating; and therefore doth not run in when the Spring of the Spirits in the Heart, whereby it moves, and keeps the Blood in the Ear from running into the Ventricle, (as a strong Easterly Wind keeps the *Thames* from going down, and causeth the Tydes to swell, and to flow thrice in one day) becomes so relaxated, that it hath not Force enough to keep the Blood out of it: whereas in other cases, when a living Creature dies by Weakness or loss of Blood; or in any other way and manner than by Strangling,
Motion

Motion ceasing by degrees, and growing weak in the Heart as well as in other parts, the Heat, saith *Hippocrates*, that is to say, the Spirits, *in moribundis locis, coacervantur*, that is, run towards the Heart, the Seat of Life, to help it; and carry some Blood with them towards it at the same time; which (the Spirits in the Heart being then become too weak and too few to keep it out) is admitted and let in; and that is the Blood is found and seen in the left Ventricle in dissecting of Bodies. The Reason that *Harvey* gives of the Heart continuing to expel some Blood after the Lungs cease to send it in, is next kin to no Reason; *first*, because the Heart hath not the expulsive Faculty which they attribute to it, as shall be fully made out in the four next Chapters: *secondly*, it were so weak (supposing that it had it) after the Lungs cease to beat, that it could expel nothing.

10. If Blood in the left Ventricle, why are not the Walls of it fed and nourished by it, as those of the right Ventricle? And we may see they are not, because the Vessel called the Coronal Artery conveys more Blood into them (to that end, as is agreed and confessed on all hands) than into those of the right: sending many more Branches to the *Septum* and the Walls of the Ventricle on that side, than on the side of the right; the Walls thereof being not so firm as those of the left, are more apt to draw their Food and Nourishment from the Blood; and so need not so many Branches of that Artery, to feed and to supply them, as the sides of the left do.

11. The *Valvulae* of the Heart (waving the Porosity of the Substance of the Lungs) are too straight to let through them that great quantity of Blood

in so short a space of time as they say passeth through it : opening but just like small chinks, fit for the Spirits only to slip in and go out at. *Eaque præcipue*, (saith Doctor Hippocrates, who never took a Degree) *Et justa ratione in vasis sinistra partis exactiorem sunt molitionem adeptæ*, that they may shut the closer. And if, as *Walaus* saith, they let out pretty large Streams when *Arteria Magna* is clean cut off from the Heart, that quantity answers not to that they say ought to pass ; for according to *Harvey*, the Mass of the Blood, which is at the most but 20 Pounds, runs out then in half an hour ; and according to *Lower*, who makes it to go round six or seven times in an hour, there ought to pass through at least 60 Pounds in that half hour. Besides, as I have said in the 4th Verse of this, there is a great difference between the Blood running out and forcing good of its way up and down through any chink *propter fugam vacui* ; and running in full Vessels upon no other account than *animi gratia*, or to please the Inventors.

12. Cold seizing more readily upon the Extremities than upon the middle parts, is another of my Proofs against the Circulation : for if the whole Mass of Blood runs throughout uniformly, being, as they say it is, the Seat of the innate Heat, it ought to heat all the Parts of the Body, and arm them, and defend them against Cold, every where equally : but we see no such thing ; and therefore, till we see it, we suspend our Belief.

13. If the Blood be expulsed only in the *Systole*, its Motion is at a stand during the *Diaſtole* ; as in blowing the Fire but with a single Bellows, Experience shews it happens : and if that Interruption of Motion be admitted, it cannot run so swiftly, nor pass,

pass, in that quantity they say, through the narrow chinks of the Lungs and *Valvula*, where a continual Force is required to impel and drive the Blood always through.

14. In fine, if the driving Force be able to drive the Blood throughout, from the left Ventricle as far as the right again; why doth it stop in the middle when a Vein is cut in two? why doth not that Force drive it at least as far as the end of the first half of that Vein, or the place where it is cut; and where we see that Force ends? for there the Bloods Motion stops, nay, stops before it comes there; being not able to keep that Vein open to the end, but suffering it to shrink in the Flesh, and to shut up.

15. For the cause of Expulsion, by making the Heart a Muscle, which Doctor *Lower* pretends to Salve all, and mend the Faults of his Predecessors by, it is fully refuted and exploded in the 10th Chapter of this fifth Essay; so that the Circulation by it will be found groundless. And from all this it is plain, that this excellent Notion is not yet so well grounded, but that any Man of Parts, that hath his Eyes in his Head, may shake it and throw it down.

The Eighth Chapter.

A further Refutation, by Questions and by Answers: and first of their final Cause.

NOW, Mr. Circulator, having thus given a pull to your Building and Structure, the next step
to

to make an end of pulling down your Notion, is to call up your Causes, and bring them to a Tryal, and hear what you have to say and offer in their behalf; that upon hearing your Proofs, every Reader may judge and discover the Mistakes, and upon the whole Matter give his Judgement for the Truth. And to perform this the more intelligibly to all, I will proceed by way of Questions and of Answers: and in the first place call up the final Cause, or the End and Use of Circulation; in the second, the Agent and efficient Cause of it; and in the third, those Causes which you pretend the Heart moves both it self and the Blood by: and namely, that of *Lower*, of the Heart being a Muscle.

And to begin with the first, to what End and for what Use your Circulation should be; tell me to what End is it? for if it be in Nature, it is not without some End and Use, and Necessity: for God doth nothing in vain: and a thing of this nature, where Life it self, as it seems by the stress you lay on it, is so much concerned in, must be (in case it exist) to some other End and Use, than to make you write Books of the Invention of it. And that we may know what good you and we are like to find by this great Discovery; please to put on your Spectacles, or to take your Microscopes, Telescopes, or what you will; and look out sharp for the best of all that the Inventors have devised and urged in the behalf of its Use.

Author. And so, pray, tell your Reasons concerning the Use of it: to what End, and for what Use doth the Blood thus circulate, pass and repass through the Heart so often, and so swiftly?

Invent. First, To convey Life it self and Aliment to the Parts; and to bring them fresh Supplies of that Substance

Substance which wasteth and recedes from them daily. *Ut partes*, saith Walæus, *dum sanguis ad singulas desertur & perreptat, melius accipere id alimentum possint, quod maxime ad earum nutrimentum & robur facit; atque calefieri*: for the Life is in the Blood, *Gen. 9. 4.* which is the Vehicle of it. Secondly, It circulates that by its Motion it may keep wholesom, and not corrupt,

Ut vitium capiunt nō moveantur aque.

so the Blood, saith he again, would grow foul and putrify, if it did not circulate. *Sanè motus sanguinis indiscontinuus requiritur*, saith Willis, de Accens. Sanguinis pag. 47. *tum propter ipsius sanguinis crasin conservandam; cujus liquor aliqui stagnationi & putredini obnoxius foret; tūn præterea ut in toto corpore circumactus, tribusa partibus singulis debita erogare possit.* Add to this what Harvey saith pag. 48. That Nature desireth that all the Blood should be streined through the Substance of the Lungs; but without shewing for what

A. Very learnedly spoken; but as much to the purpose as if you had said nothing: for *first*, If to convey Life, it is essential to Life, and Life can't be without it. But it can very well be without it, as hath been shewed. Then, *secondly*, if to be the Aliment of the Parts, they are nourished by it; but they are not nourished by it, but by the Spirits which are in it, giving Life, *2 Cor. 3. 6.* for *alimentum non est alimentum*, saith the Great Doctor in his Aphorisms, *antequam intenuēs vapores convertatur*: that is, it is not the Food and Aliment of the Parts before it becomes a thin or a Spiritual Vapour. And as the Spirits give Life, so by them alone the Parts and Body are kept alive, that is, nourished and fed; for *iisdem nutrimur rebus quibus constamus.* And
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it is on this account of their conveying both Life and Aliment to the Parts, that they are called Vital. *Thirdly*, If to feed the Parts, what needs the Blood circulate when it is already spread and distributed through all the Vessels to all the Parts? and when that which circulates is not the same as becomes the Aliment of the Parts, but that only, as they say, which stays behind in the Parts; and which, if left once a Week, might answer that end as well? *Fourthly*, How can the Parts be caled by the Blood, which is cold of its Nature, and hot but from the Spirits, as hath been shewed from *Galen*? And why not rather by that which gives the Blood all the heat it hath, *viz.* by the Spirits? And the Blood is not that which keeps us warm, and gives us Heat, since we suffer more from Cold in the Legs and in the Hands, through which all the Blood passeth, according to their Notion, than about the middle Parts, where the general Store-house and Spring of the Spirits is, and from whence they are dispers'd and sent forth into the Parts.

And for a Motion of Blood to prevent its Corruption: my Answer to it, is, that it might move in its own place by the Spirits within it; and thereby be kept as free from Foulness, and from spoiling, as by being Foot-balled from one place to another. Wine it self doth keep sound so, tho' stagnant in its Vessels. And the Waters of the Sea are not kept from corrupting by their ebbing and flowing: for this Motion of the Sea is only in its Surface, it never moving in its deep places at the bottom. What keeps them from corrupting, is, by becoming Saline; and they become such by the Influences of Heaven; which are nothing but Spirits corporifying themselves, and becoming Salt in them: nay,
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all the running Waters keep wholsom but by their means; and are better than other stagnant Pump or Well Water, but by laying exposed to the said Influences that is, open to the Air. And so, by this very means of the Spirits we breath in from Heaven and from the Air, and become Salt in the Blood, as appears from that it yields a deal of Spiritual Salt, (which Chymists call Volatile) the Blood may keep sweet and sound without running round about. In the Plague, the *French Disease*, the Biting of a Viper, and in all putrid Fevers, the whole Mass of Blood corrupts by the contagious Spirit or Influence from the Air, from the venomous Creature, or venereal Poyson, which infects and suffocates the *Spiritus Custodem*, or the Spirits natural to the Blood or to the Parts (properly the innate Heat) as far as the Heart it self, and *drinks up*, to use the words of *Job 6. 4.* the Vital Spirits, notwithstanding their Motion, and the Motion of the Blood; which is not therefore that thing which keeps them from corrupting, and from being infected. Now, as they are infected, notwithstanding their Motion, so they may keep, and do keep free from it, without Motion.

I. Then it moves in *circulum* to re-impregnate it self with new Spirits as often as it passeth through the Heart; becoming barren and cold by feeding and by warming the Parts, saith Doctor *Harvey* pag. 51.

A. But if the Spirits can go of themselves into the Blood, and through it to all the Parts without your Circulation; the Blood needs not circulate nor go for them, to become well impregnated with them.

I. When

I. When you shew that we will Vote its Circulation needless.

A. Whether you Vote it or not, it is already proved such. You confess them in the Blood : and Blood being a cold thing it self, cannot produce them ; so that since they are in it, they must come from somewhere else, and something else than the Blood, if the Blood doth not fetch them. A proof they come of themselves, is, that the Blood moves by them ; and they may as easy come of themselves as move the Blood. They come, saith Doctor *Harvey*, out of a cut Artery with a continual Motion ; and they make the Blood to leap out of it and of the Heart with great force and *impetus* ; therefore they come of themselves, or are sent out of the Heart. But if the Heart sent them forth, their Motion and coming out would not be continual, but like that wherewith the Heart pulseth, *viz.* by Intervals ; so the Heart doth not send them. And the Blood cannot leap out with *impetus* of it self, but only by the Impulse of that which all *impetus* or force of Motion comes from.

The Beams of the Sun come down of themselves into the Air, making the Air a Spirit ; or, however, a Vapour spiritual, uncondensable, and next kin to a Spirit. This Air runs towards the Flames and any Vacuity ; and moves swift when it blows hard of it self ; and by the Force and the Elasticity of the Spirits within it, since we see no other Force or Bel-lows to impel it.

The Heart heaves, the Arteries beat and pulse, and the Blood leaps out of them by the Spirits ; and all Force and *Impetus* in the World proceeds from them ; and shall that which moves all things be denied the Faculty of agitating it self, and of coming into that, which as we see, moves by it ?

But

But Fermentation alone can make out, that this Motion of theirs is spontaneous: for what sets them in motion when they work in new Liquors, and cause Wine to boil over and run out of its Vessels? What makes a Serpent nimbler than any other Creature? and his Heart, and the pieces of his Heart and of his Flesh, to beat and wriggle a great while after all the Blood is out; but the great store of Spirits they are imbued and boile with, as appears from their being full of a spiritual Salt?

And by what doth that part which *Solomon* saith is hanging as a *Burthen* in old Age, *Eccl.* 12. 5. become so active and brisk, and so ready to leap out of its own Skin in young Men, that for this Reason, it seems, he calls it a Grasshopper, but from the Spirits that run of themselves into its Nerves? for the Blood doth not bring them, since no Blood is in those Nerves when they are so distended. And if the Heart sends them forth through the Blood into those Nerves, the Blood, as was said before, hath no need to go for them.

And whence in Phlebotomy, as *Harvey* himself urgeth pag. 74. doth the Blood that was running, stop its course or run briskly upon either Fear or Hope? but by means of the Spirits; upon which there comes a Damp, or an elevating Fit, by the Imagination struck with the Apprehension of either Evil or Good. For the Imagination cannot work upon the Blood, but upon the Mind only, which determinates the Will; and the Will determinates the Motion of the Spirits either forwards or backwards; making them to run forwards or to shrink up and stay in, giving them the Impression which it receives from the Mind and the Imagination: So that by striking a Damp upon them, in case of Fear,
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the Heart finds it self in streights, bound up, and dull and heavy ; no light can break out therein and send out Beams or Spirits ; and the Spirits and the Blood stop their Motion upon it. And in case of Hope, the Heart becomes light, free and open, and full of Light and Gladness, *Esther* 8. 16. and yields its Spirits freely, upon which the Blood runs on merrily, saith *Aristotle* to *Alexander* the Great. The Poets, without your Skill in the Art of Dissenting, knew better than you the Cause of the Blood standing with Fear, and of its being lively by the access and recess of that which stirs up all things.

*Spiritus intus alens per quos diffunditur artus,
Hos agitat . . . Gelidusq; stetit formidine sanguis.*

Spiritus est organum & manus summi Dei, quo agitantur omnes in hoc mundo species ; & cujus absentia & otio quiescunt, saith Divine *Trismegistus*. I wonder that *Harvey* could see that the Heart grows faint, and the Pulse slack its beating, and the Blood ceaseth to move when Fear comes upon the Heart ; and should, without more adoe, and all further Enquiry, ascribe the Cause of all this, in the page above cited, to the Faintness of the Pulse ; which is it self the Effect of that Fear, and of the Damp of the Spirits in the Heart : which therefore, as it appears from all this, move of themselves. But adjourning what remains of this to the second Part we will end this Chapter here.

The Ninth Chapter.

Refutes the next thing to be lookt in, to wit, the efficient Cause which the Inventors assign of the Motion of the Blood, by Expulsion from the Heart.

A. **H**AVING done with the first thing, viz. the final Cause or End, and Use of Circulation; let us hear what you can say for the Efficient of it. Doth the Blood move of it self, or is there another Cause efficient of its Motion?

I. No Body, that I know, saith that it moves of it self; being, as you have urged, but a cold unactive thing, and receiving its Motion from the Impulse of the Heart.

A. Yes; *Harvey* seems to say so in affirming, that the Heart moves and dilates by filling with the Blood that runs to it, and assigning no other Cause of its Dilatation: And Doctor *Willis* also, by making the Blood the Seat and *Focus* of our Heat, saying pag. 51. of his *Accension of Blood*, That *non sanguis a corde, sed cor a sanguine calorem mutuatur*. For if it borrows not Heat from the Heart or other things, it must have it in it self, and consequently Motion, which is the Cause of all Heat. Doctor *Lower* seems likewise to ascribe Motion to it, saying pag. 81. That the Hearts *Diastrale librat* adeo *vicibus non succedit nisi a sanguine in illud irruente*. But what is than the Agent of the Motion of the Blood? from whence comes its turning round, and

its Truſſion through the Veins, with the Force and the Swiftneſs which you ſay it doth it with ?

I. From the Heart, by virtue of its expulſive Faculty, whereby its Ventricles ſtretch and diſtend to receive Blood, and contract to expel it ; like the Bladder and Stomach, and the other Cavities, when they let out the Urine and other things they contain ; according to *Waleus*, who ſaith, *Eandem eſſe conſtrictionis cordis ac ventriculi atque veſica rationem.*

A. How are the Ventricles filled ? do they fill up of themſelves ? or doth the Blood run into them ?

I. They fill like Sachels or Bags, which lye open to receive, as Doct^r *Harvey* teacheth : *Vel extenduntur hoc quod illis immittitur*, as ſaith *Waleus* again ; *Et quando expulſere ad naturalem ſuum ſtatum redeunt.* So that if the Blood runs not into the Heart of it ſelf, it is drawn in by the Heart, either by ſome attractive Faculty of its Ventricles, or by their beating about, as *Harvey* ſaith pag. 40.

A. A cunning way of drawing newly found out in the Heart ! whereby it draws and expels like thoſe Magnets which are ſaid to have a Theame-diſm, that is, repel with one end what they draw with the other. But if they fill up like Bags, why don't they empty themſelves like Bags, by running over, without pulling in their Strings, and making uſe of their Nerves to contract and to expel ? The Stomach and the Bladder, we ſee, have Nerves and Sphincters, to draw them cloſe together, and gather them like a Purſe : but in the whole Heart we ſee none but a ſingle Soul one : which belongs, ſaith *Bartholin*, to the VI Conjugation ; all the Filaments *Lower* doth give the name of Nerves to, being really

ly but Fibers: and besides, this Nerve serves but to its motrice Faculty; for we see when it is cut, the Heart moves nevertheless. And the expulsive Virtue of the Stomach and Bladder consisteth in expulſing, and then drawing themselves close, or contracting of themselves at their Mouth or Orifice, after they have turned out; and not in contracting first, and afterwards expulſing. Then the Mouth or Orifice of the Ventricle lies open as well in the Contraction as in the Dilatation; and is never drawn so close as is that of the Bladder; the Contraction of the Heart being of the whole inside; and (by an Observation of Doctor *Lower* himself, pag. 154.) of the whole sides of the left Ventricle, coming together. And if the pretended Nerves can shut and open the Heart, what are their *Valvulae* for, shutting and opening of it, and letting things out of it at every Pulsation? Moreover, if it expel like the Stomach and Bladder, what is that sends Blood upwards through the ascending Branches? for the Stomach and Bladder send and thrust nothing upwards; at least with the usual Force; as if one Piss'd through a Pipe going directly upwards, he would find that he must put more Force than ordinary to it, if he would have it to run over at the top; more Force being required to thrust up, than to let out: and we do not feel we put more Force to this pretended Expulsion of the Ventricle, than we do in letting out Urine, or Pissing a Bed: nay, we never felt the Blood coming out of the Ventricle, tho' we mind it carefully: whereas we can feel Urine coming out, tho' fast asleep: So that the Heart expels not like the Bladder and Stomach, in case it expel at all.

As for its being capable to impel the Blood forwards by Trusion through the Vessels, give me leave to deny it: for it must then be equal or superior to the weight of the whole Mass of the Blood; which you say is from 20 to 25 pounds; and such Force as that is,

*per rumpere posset
Saxa, potentior idu fulmineo.*

would be equal to the Force, not only of a Cross-Bow, but of a Demy-Canon. Whereas we see it is not equivalent to one half, or any part of that weight: for when Veins are cut in two, the Blood stops, and runs no more; and is not thrust by that Force so far as the very end or place where the Vein is cut; for the same Vein doth shrink vp; and closing, stops up it self, (as it is notorious to all the Practitioners, who cut bleeding Veins in two, when they cannot stop the Blood in them any other way) but it should be kept open, and the Blood should run and spout out of it, if the said Force were able to drive it through: which we see it never doth; and therefore is not a Cause sufficient for this Effect; that is, to thrust the Blood through from the left side to the right.

But, suppose that Force were such as could drive the Blood throughout all the way continually, it ought to keep constantly and continually open the *Valvula* of the Heart; in which case there would be none of that opening and shutting by Intervals which they have. And if they open and shut, you must grant a stop or pause in the Motion of the Blood all the while they remain shut: which stop would prevent its speed, and its gallopping so fast, and in such quantity, as you imagine it doth.

And

And if the Blood moves only by Expulsion from the Heart, how comes the *Vena Cava* to beat, as it hath been said, whilst the interjacent Veins which lie nearer to that side of the Heart which expulseth; and through which Motion should come from the Heart to the *Cava*, never move or beat at all.

A Snake, when she darts her self, thrusts forwards her whole Body, which lyes even in her Skin, as the Blood doth in the Veins. Now, doth her Tail thrust her Head and Body? or doth each part thrust and help it self forwards by its own Strength and Spirits, (which you know they abound with?) By the last, you must needs say; for tho' her Tail lye along on the Ground without Motion, she can dart and thrust her Head nimble this way and that way, and raise it up with a part of her Body from the Ground. So that if each part of her moves and thrusts it self forwards by the Strength of its Spirits; why may not the Blood do it, being as full of Spirits? And why can you not see that it doth actually do it, being just under your Nose? *Eccl.* 2. 14. or at least acknowledge it when another shews it you? And if you have more to say for your Expulsion, say on; and shew some other new Cause efficient of your Notion.

The Tenth Chapter.

Refutes the other Causes assigned by some others: and amongst them that offered by Lower and by Willis, of a Musculosity.

A. **G**O on, Mr. *Innovator*, gird up your Loins like a Man, and muster up all the strength

of your Modern Wit and Skill to prop up your Invention, which, if I mistake not, is in a tottering Case, and falling down already. Have you any more to say concerning your Expulsion?

I. Yes. But you must give me leave to follow my own Method, and answer you my own way, by telling you what *des Cartes*, and other great Authors say.

A. Do so: take it, and prosper.

I. *Des Cartes* is of Opinion, that two drops falling at once (one from the *Vena Cava*, and one from *Arteria Venosa*) in each Ventricle, are both rarefied therein by the great Heat of the Heart: and turning to a Vapour, which swells and dilates the Heart, they thrust open in the puff its Portals or *Valvula*, and make their way out of it (when it can stretch out no more) into the Arterial Vein and *Arteria Magna*; upon which the Heart maketh a Pulsation, and Subsides.

Cremoninus deduceth his own partly from the same, to wit, a Rarefaction; partly from Ebullition, and a Resistance of the massy Substance of the Heart, which lets not the Vapour through; and subsides by its own weight after the Dilatation: as the Earth doth in Earth-quakes, swelling and bursting open by the Force of the Vapour, then falling to and closing, after the Vapour is spent.

Hofman ascribes Pulsation to an Inequality of the said Ebullition, which, as in boiling Water, causing some Parts to ascend, and some others to descend; because condensed again, or not rarified enough, makes the Heart to rise and fall, and to beat by Intervals.

Doctor *Willis* and *Lower* rejecting these Opinions, stick to that of Expulsion; but being unsatisfied

fied with the blind Account given by all others before them; and forced by Truth it self, to acknowledge the Concourse and Influence of Spirits in the Motion of the Heart; they say the Heart is a Muscle, and all its Fibers Sinews, which draw, dilate and contract, and move, like all other Nerves, by the Animal Spirits: so that when the Heart is full, it expels the Blood by them, and drives it in the manner that was expressed before. *Willis* adds to Expulsion a Flammula in the Blood, burning all the Blood over; saying pag. 51. of his kindling of the Blood, that *licet cordis motus sit tantum animalis, atque a continuo visceris hujus motu circulatio dependeat, cor tamen a sanguine, & non sanguis a corde, calorem omnem suum mutuari videtur.*

Here are Causes of all sorts; and if these are not enough, seek another where you please; for I have done my part, that is, told you the divers Opinions of the Authors, as all Professors do now in reading of their Lectures; and if none of them please you, you will never be pleased.

A. You have shew'd, that you can Read, and remember what you Read: but if they play no better the part of Philosophers, who read in the publick Schools, than you have in this Answer, we are like to learn the Truth better without, than by them. But if, as it hath been shew'd in the last Chapter but one, there is no Blood in the left Ventricle whilst we are in Health, what will become of all your Authors? and why should any of their Causes please me then? And, truly, without this Cause and Reason of my dislike, none of them all please me well: upon some other Accounts, which are,

First, That a Motion by an Effervescency, and by an Ebullition, caused by a Heat capable to set the

Blood a boiling, and turning to a Vapour, of that force and *impetus* as is capable to drive the whole Mass of the Blood through the Habit of the Body, from one side to the other; supposeth a Heat that would parch up and burn all the Parts, beyond drinking of Brandy, and any burning Fevers. Then this Blood would become Blood again presently after in mixing with the other: and to what end should the Blood rarefy in the Ventricles, and there become a Vapour, to condense again to Blood in the very next Vessels? *Thirdly*, This Rarefaction of the Blood in the Ventricles would in time fill them quite up with the gross and earthy Parts which must of necessity be left in great quantity (the Blood, witness Experience, having abundance of them) behind in the two Ventricles; as in the Distillation of all other liquid things, there is a Settlement seen of *Feces*, or earthly Parts.

Secondly, The Opinion of *Lower* and of *Willis*, tho' cry'd up and admired as salving every thing, doth rather perplex, and serve to intricate the Notion, than add any light to it. And with the many Reasons they bring *ordine longo*, with a word of apparat, to make of the Heart a Muscle, they have set the Invention as far back and behind hand, as it was in former days, before it was thought upon.

For the Invention it self, of making the Heart a Muscle, and all its Fibers Sinews, is due to *Hippocrates*; who in his Book *de Corde* expresseth it in these words: *Cor musculus validus*, saith he, *membranas habet, quæ in solidam cordis carnem & substantiam filamenta immittunt; & quæ mihi videntur visceris esse nervi.* But the Use they make of it being rather an Abuse than an Improvement of it, sets it back more than it was in *Hippocrates* his days,
and

and leaves us further to seek than if we had not known it. The Use which *Hippocrates* himself did make of it, is, that by its being a Muscle, it keeps in the Heat better; *Et vasorum aortis principia exhibet. Cor musculus, non nervis, sed carnis spissamento, validus: Et crassitudo ista intus illi extructa ut calidi robur melius custodiat.* So that if the Heart be such, it is more on the account of its moveable Substance, (which, saith he, moves of it self all over without the help of any Nerves or Fibers; *Siquidem tota sua natura agitur*) than of its Fibers or Nerves. And by his Definition of a Muscle, which is *caro in orbem circumacta*, it appears, that when he gave the Heart the name of a Muscle, he did it more in regard of its Form and Consistence, than of its Fibers or Nerves. And, truly, the Nerves are not that which constitutes a Muscle, nor so much as part of it.

And that the *Parenchyma* or the Substance of the Heart moves not by means of its Nerves or Filaments, or Fibers, but by the Spirits lurking in each part and pore of it, appears most evidently from its moving a great while after it is cut and flasht, with all its pretended Nerves, into a thousand pieces; for the said pretended Nerves being cut, can draw no more: and the truth is, that they are, and serve for no other Use than like the Skins which are seen in coagulated Blood, to keep the *Parenchyma* (which is composed of Blood and of the Vital Spirits) together; and to give way, or yield when the Heart riseth, *atque ut principia vasorum exhibeant.* And if their Use was to draw, and cause the Heart to contract, they would gather together the whole Substance into plaits, like a Purse, or the *Anus*, or the Mouth of the Stomach: but they never did it
yet;

yet ; the Heart being too massy, and the Walls of its Ventracles a great deal too thick for that. And Doctor *Lower* hath shew'd pag. 154. that it doth not gather so ; for keeping his Finger in the left whilst it contracted, he, instead of such Plaits, saith he felt that the whole sides brought themselves close together, and compressed his Finger, as if press'd between both Hands. And *Waleus* confirms this, finding by Experience, that the *Septum* doth not move at all in the Constriction, the Motion of the Ventricle being of its Walls only, that is, of its Anterior and Posterior Parts clapping and coming close together : and not, as *Harvey* asserts, of the *Septum* and the side which is opposite to it : the words of *Harvey* are, That it contracts every way, especially on the sides, pag. 18.

And the Palpitation felt in the *Septum*, is a Proof that the Substance of the Heart moves by the Spirits lurking and running into its Pores ; for tho' the Agitation was felt only in that part, by reason of the Passage of the Spirits through its holes from one side to the other ; yet so long as the Spirits being yet but natural, (or courser than the Vital) can run from the right Ventricle through the Pores of the *Septum*, and move and agitate it ; it shews, that they can also run and insinuate themselves into the Pores (tho' streighter) of the rest of its Substance, when they are become Vital, (finer than the natural) and move and agitate it without the help of its Nerves. And its wriggling and beating when all the said Nerves are cut, puts this thing beyond all doubt : as also that it moves not like a Muscle by its Fibers ; but more like a Nerve it self, and like every Particle of the Substance of the Sun, which is all Spirit and Light. If the Heart, as both *Harvey* and *Hippocrates*

pacrates affirm, be nourished from within by the Spirits which the left Ventricle attracts from the right, these Spirits must insinuate themselves and run into it at the Pores of its Substance.

This is a strong Argument against you, *Innovator*, to wit, the Heart moving on, tho' that which you call its Nerves, and the only Nerve it hath, be cut into small pieces; nay, and stirring out the Blood three or four Foot from it after Gashes are made in't, and its point cut off from it. But, tho' it be strong enough of it self to run you down, and put you to a *nonplus*; yet I have more great Guns to batter you to ruine. For granting the Heart a Muscle, and as many Nerves to it as you think you found in it by your Microscopizing, what then if they do not move by the Animal Spirits?

I. But they do, like other Nerves, as *Lower* demonstrates it.

A. And why not by the Vital which the Heart sparkles and boils with?

I. Because he saith they are Nerves; and the Nerves, as all say, move by the Animal Spirits.

A. I thought Inventors were above the Rules and Method prescribed by other Men. But now, that all things are done according to *la Methode* in Church, State, Law and Physick, the Fashion may be likewise followed by Inventors. A Preacher sings at the Desk a long *Oremus fratres*, which, after a Psalm is sung, he repeats in the Pulpit; then takes and divides a Text into as many Members as he can spy out in it; and so the next, and the next, and as many more as come: and there is preaching, hearing; and hearing, and no doing; and the more *Pater Nosters*, or the more Sermons one hears, the better God is served, tho' the Hearers mend upon't

as

as much as the Papists do for hearing many Masses : for it is turning, turning, and the way to turn, and come to the Birth of the Spirit which Preachers should inculcate, *Joh. 3. 5. Gal. 6. 15.* for what signifies to one to inveigh against his way, to wit, the Love of the World, whilst his Mind runs upon it, and he doth not turn from it ; and so hath no Heart nor Ears for it, to hear and obey in hearing, *Mat. 13. 15.* or to believe : and they preach as to Hearers which are already turned. Because one translates *moving on the face of the Waters*, and *Hypostasis* Person, others must translate so too : and because one saith he seeth a Circulation in Blood, the other must see it too : all Physick and Chymistry, and all Trades and Sciences are brought to meer Terms of Art, meer Receipts, a meer Method : all things are done *proforma*, formally ; Formality is now the Soul of the World. And had it been so of old, what Inventions should we have ? But, without going to work according to your Method ; without going to see you cut the Throats of Cats and Dogs, and Butcher Men and Women, I will shew you in them that which you will never find by cutting up of their Breasts, *viz.* that the Heart doth not pulse by the Animal Spirits, but by those which we draw in Life and Respiration from.

I. Pray do ; and all the Surgeons and Physicians will thank you.

A. If they do, it will not be according to *la Methode* ; the World is not so civil : the usual way of the World being to Stone its Prophets, or those that would instruct it ; and to be as much in Love with its Plague and Ignorance ; as the *English* with their Laws, and *Spaniards* and *Portuguese* with their *Ah, que ha da fe* ? that is, their Inquisition. The *Shepherds*;

herds, that understand nothing, are the most in Vogue. *Isa.* 56. 11. But without any prospect of Thanks, I'll shew it you. You know, that when we run fast, or work hard, or are in pain, we are out of Breath, in Streights in the Breast and in the Heart, and grow faint, and cannot speak, for want of Respiration; and the Motion of the Heart grows then weaker and quicker by reason of this Faintness, as *Lower* doth acknowledge pag. 161. and both the Heart and the Lungs being then hard put to it, beat and belabour themselves, as may be seen by the Flanks of a Horse, which heave and beat faster than ordinary after he hath been Rid hard. The Reason of this Faintness and hard Labour of the Heart, is, that by the violent and swift Motion of the Parts, great Loss and Deperdition of Vital Spirits is made, (as it appears by the Froth which a running Horse, after a Race, is cover'd over with; that Froth being but his Sweat divided into Particles by the long Hairs of his Skin, and blown into minute Bubbles by the Spirits exhaling from him so abundantly, that they can rarefy it; as Boys do soapy Water by their blowing into it) so that the Lungs and the Heart, from which the Parts are supplied, must rise and fall, pulse and draw, and make their greatest Efforts to supply that waste and loss, and bring both sides together, (whence came the hard Compression of Doctor *Lower's* Finger, pag. 154.) to press and squeeze out as much as possible all the Spirits they suck in by dilating: but their not coming so fast as they are sent forth, and as they are wanted in the Parts, is the cause of want of Breath, and that we must stop to breath, being ready to drop down when we outrun our Breath: which drawing in of the Air is more sensible in frosty and cold, than in hot Weather.

Now,

Now, it being plain from hence, that this Motion of the Heart is caused by breathing in and expulſing theſe Spirits; and that theſe Spirits coming from the Lungs and from the Air, without paſſing through the Brain, are not Animal Spirits; it is plain and ~~manifest~~ alſo, that the Heart moves not, that is, dilates and contracts not, attracts not and expels not, by the Animal Spirits. And from that the Head is clear of that Labour which the Heart and Lungs ſuffer all the while, it appears it hath no ſhare in ſupplying of the Parts and of the Heart with Spirits. But, that the Heart, like the Sun, being a Centre of Life, and its Subſtance like to that of the Body of the Sun, whereof every Particle is Fire, Light and Spirit; doth ſupply every Part with the Spirits which it draws through the Lungs and through the right Ventricle, from the great World, or the Air, and from the Viſuals.

Since the Heart ſupplies the Head and all the Parts with Spirits, and moves before the Head is, or at leaſt before it ſends any Spirits into it, for it is the firſt Mover, what need hath it to receive Spirits from the Head to move? or of Animal Spirits? All Spirits come from Heaven into the Air, as was ſaid; and from the Air into us, immediately through the Lungs, and mediately from the Viſuals through the Stomach and Liver. In the Chyle and the Liver, as far as the right Ventricle; they are called Natural; in the left they are Vital; and Animal in the Head: ſo that the Vital Spirits are before the Animal; and there are Vital Spirits in the Seed, and in the Bag of which Embryos are made; before the Embryos come to have Animal Spirits, and a Head to make them ſuch: and to make them Animal, there muſt be an *Animal* or a Soul fit to uſe them, which they derive
their

their Name from, and is not in the Body before the Head is formed. And, therefore the Animal proceeding from the Vital, which the Heart sends to the Head, are not those which it moves by when it draws and sends them forth. I wonder at three things: *first*, That Doctors, of all Men, know so little of their own Trade. *Secondly*, Who will pay me for thus teaching you Phisick? *Thirdly*, How many have you cured by Anatomy, and by helping forward the Circulation of their Blood?

A Muscle is an Instrument of voluntary Motion, being moved by the Will, a Faculty of the Soul; which sends Spirits into it through their Channels from the Head, where the Soul sits in its Throne, and where it acts according to the Reports which are made before it by the Senses. The Thoughts arise in the Heart, but the Notions and Conceits, which determinate the Will from the Objects, in the Head. Now, the Heart doth move without, nay, and against our Will; and therefore not as a Muscle, nor by that which moves a Muscle, to wit, the Nerves or Fibers, and the Animal Spirits.

The Lungs are not Musculous, yet they move and heave, and rise and fall as well as the Heart; and without Fibers or Nerves keep Pace and Correspondence with the Motion of the Heart. And so may the Heart therefore, without being Musculous, move and heave as well as they by the same means as they do, *viz.* the Breath or the Spirits which they draw by dilating.

To make an end of Beating and Playing you with great Guns, I'll add but one thing more, which *Low-er* hath alledged pag. 126. *viz.* That *mirum in modum à potu vini boni, sive spirituosi, cordis motus augetur*: that the Spirits of the Wine we drink help
the

the Heart's Motion in a wonderful manner: so that the Heart moves by them, seeing they help it to move. Now, the Spirits of that Wine are but natural Spirits before they come to the Heart, and but Vital when in it: therefore, since it moves by them, it moves but by the Vital, not by Animal Spirits.

But, it seems, you suppose that they get up into the Head, and so become Animal before they go to the Heart: for he saith in the same place, *Has partes spirituosas in caput exstillatas, spiritus cerebri incolas in similes tumultus incitare*: and hence in his Opinion; *first*, They go into the Head before they get to the Heart: Then they help the Heart to move *magna sua copia*, because of their abundance, and because their abundance raiseth Uproars in the Head; and so make it always light, and never dull and heavy: And *thirdly*, That those Spirits are tumultuous before they rise up in our Heads, since *alios incitant in similes tumultus*: which is Low-Country, that is, Dutch Modern Philosophy.

And to begin by the last; if they are tumultuous before they get in the Head, how come strong Wine and Brandy to be quiet in their Bottles, even in a greater heat than is that of the Stomach? And if by their quantity they become tempestuous, and so help the Heart to move, then the more, the merrier; the greater the Disturbance, the better should the Heart move. But we see the contrary; for after a Drinking-bout the Head is out of order, and the Heart dull and drowsy. And the Schools by Experience, declared in their Proverb, have found, that *Bonum vinum acuit ingenium*, when taken moderately; for when in great quantity, it makes one look like a Sot, and helps neither Heart nor Head. If *famem vini potus solvit*, the Heart may be help'd by drinking

drinking a Glass or two. And Doctor Willis affirms pag. 65. de Accens. Sang. *Se novisse virum ingeniosum, qui a pleniore vini potu literas clare sub atra nocte perlegere poterat*: which, if true, shews it was done without Uproars in his Head; or else, instead of seeing distinctly, he had seen double.

And if the Spirits of what we drink rise into the Head before they get to the Heart, then they take a way to it divers from that of the Victuals; for these go first to the Heart, because the Heart being that which supplies all other Parts with Spirits and Aliment, is the first that must be fed; (according to the Prophet, *Lament. 1. 11. they sought for Meat to bring back their Souls*, which, as they took it, *Gen. 9. 5. and as you take it your selves, by making the Heart the Spring, Fountain and Cistern of Blood, was in the Heart and the Blood*) sparing none of its Spirits to the Head and other Parts before it be fully fed. And if they go directly from the Stomach to the Head, why do we feed at the Mouth, and not rather at the Nose with sweet Encense, like the Gods; or with Snuff, like the Spaniards? *Citius vini potu refectimur quam cibo*, saith Doctor Hippocrates: therefore the Spirits of Wine take the shortest way thither, not a longer way about than those of all other Victuals; and so rise not to the Head before they go to the Heart. You say, that all that we drink passeth through both the Ventricks before it can get into the Kidneys and the Bladder; and that you have known a Man, who having drunk two Gallons of Water in a Morning, voided the same quantity in three or four hours time, pag. 159. If so, pray Mr. Doctor, did all that Water go through his Head in that three hours time, without causing it to ache, and occasioning a Rheum?

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But,

But, to conclude the Dispute; let the Heart be musculous, and move, as you will have it, by the Animal Spirits: you cannot, as hath been said, deduce from thence its constant reiterated Motion; that is to say, shew by it how the Animal Spirits, which move but by the Consent and the Determination of the Will, go constantly from the Head into the Heart as often as it pulseth, whether we will it or not: for you say it is too high for Man to understand it; for your selves, you should have said, for I know one who doth: So that all your Endeavours of making the Heart a Muscle, and all its Fibers Sinews, ending in an Expulsion and expulsive Faculty, (which is null, as hath been shew'd) leave the thing *in statu quo* you found it when you begun, shewing no more than what was well known to others before, and denyed by no Body, *viz.* a Motion in the Blood, and nothing of its true Cause.

And, as for Doctor *Willis* his kindling or accension of Flames in the Blood it self, it is a thing impossible; because no Light can break out where Moisture predominates, and where the Spirits cannot concenter, as shall be shew'd. Now, the Moisture abounding, and the Spirits being spread and diffused in the Blood, and the Vessels it runs through; no Flame, tho' never so small, can kindle or break out in it: this breaking out being done only in the left Ventricle, which being round like a Sphere, and smaller than the other, and without Blood, or empty, is fit to coacervate and concenter the Spirits; and thereby to make them flash and break out into a Flame. And as the Veins and Vessels which the Blood runs through, are full, no flash can be made in them; for, as *Willis* grants himself, no Flash or Flame is kindled but in a convenient space, where
it

it can send out its Fumes, such as is the left Ventricle: nor are the other two things he offers pag. 52. as sufficient to produce and to keep a Light burning, capable of effecting it; as shall be shew'd in its place.

To what he saith, that the Heart borrows its Heat from the Blood, and the Blood notwithstanding hath its Motion from the Heart, it is so inconsistent with Reason and with Nature, that it deserves not Answer. For the Blood, in the first place, having no Heat of it self, cannot give Heat to the Heart; and if Motion comes from Heat, or is no where without it; the Heart borrows with its Heat Motion from the Blood also, and so gives it not the Blood. Or, if it gives it to that whence it receives it it self, it is a Discovery, which, if it could be made good, would actually put an end to all further search after a perpetual Motion.

From all which it appearing, that all the Causes you give of the Motion in the Blood, and of its Circulation, are null'd and of none effect, being either deficient or inconsistent with Life, or having neither Being nor Existence in Nature, I will in conclusion stop your Mouth with Christ's Answer to your Fellow Inventors of a Non-Resurrection, *Mat. 22. 29. You err, not knowing Scripture* (the Writings of the Ancients) *nor the Powers of Nature*, (which is God manifested) *viz. Spirit, Heat and Motion.* The Spirit being *the Arm*, the Tool and Power of God, *Joh. 12. 38.* whereby he produceth all, and sets all things in Motion. And there being no Reason why we should like or admit any of them for the Cause of your pretended Effect, and why you should not desist of an Effect hath no Cause, you must now give up the Cause; because *cessante causa cessat effectus*

fectus quoque, or exhibit another more adequate or better.

I. Why so? why should not the Cause which *Harvey*, *Willis*, *Lower*, and all the Virtuosi and the Learned of the Age approve of as adequate, to wit, the expulsive Force of the Heart, satisfy you? Why should you find fault with it, when all judge it to be good? *Are you greater than our Father Harvey, and Galen (whom Harvey borrows Proofs from) who gave us this Well, from which so much hidden Truth is drawn, and drank of the same himself, and all his Children with him?*

A. And his Cause also, good Sir, not to forget your own self; for so it is in the Text, *Joh. 4. 12.* But, if the thing must be so, because your Fathers say so; and a *sic dixit* is like to be your *nonplus ultra*, great Improvements of Knowledge are to be made by your means! *Si ipsa terrestria quæ sunt in sanguine ante oculos vestros nondum intelligitis, quomodo coelestia, quæ sunt in anima & in lumine ipso vitæ cognoscere?* *Joh. 3. 12.* But we won't be put off so: and now, you have had your Way, and taken your own Method; I will have mine also, which is, to know if you have any other Cause to shew, and if you will yield or not, in case you can produce none; for if your Philosophy, which is, to know *per causas*, be at an end with this Cause, how can you hold out longer in Argumenting for it?

The Eleventh Chapter.

The Refutation of another Opinion; which is, that the Soul acting upon the Parts without Mean, that is, without the Spirits, is the Cause of Expulsion.

A. **T**herefore, Mr. Innovator, answer directly or yield. And since Expulsion, it seems, sticks so fast in your Gizzard, that after all hath been said against the Non-sense of it, you cleave and keep still to it, say if
you

you have any more to shew for it; and answer, from whence comes the Heart to have an expulsive Faculty, otherwise than what you said, and what hath been refuted.

I. Either from the Soul her self, acting immediately upon the Parts without the Mediation of the Spirits; or from the Vital Spirits, which you say the Heart boils with. *The Soul*, saith Dr. de Back, *being given to the Parts, as an impulsive Spirit, to perform all their Actions; and the Faculties being but the Powers of the Soul, it is she that performs them, as present every where; and doth, as an Artisan, when she finds fit Instruments, perform them of her own self without the Mediation and the help of the Spirits.* And to have recourse to them, is, saith he pag. 11. *to multiply Entities without a Necessity.* See this pag. 6 and 12 of his Treatise of the Heart Printed with Dr. Harvey.

A. This is as great a Wisdom as the Dutch Repartition of the Spanish Monarchy; and as good every whit as that of the same Author in the 13th paragr. of the 5th chapter of this: for by it, and what he saith further in the same pages, *That the Parts are enlivened by the Powers of the Soul; and warmed and made moveable by the Blood circulating,* it appears,

1. In the first place, That whilst he denys Spirits, and frames Reasons against them, he establisheth the same, making the Soul a Spirit.

2. Secondly, By making it a Spirit, and affirming that by it all the Actions are performed in the Parts, he makes out that very thing, which he hath been at the Trouble of a whole Book, to refute, viz. that the Parts and the Blood are moved by the Spirits. A Gribouille Philosopher that runs into the Water to save himself from the Rain!

3. Thirdly, He makes of the Soul an Artisan, who is independent of the Matter, and can't work it without Tools; yet binds her to the Matter, and doth allow her no Tools, or no Spirits to work with; and thinks to save by putting his Soul upon the Office and the Work of the Spirits, whilst, for want of her own Work, which is, to use and exert the Understanding and Will, her own proper Faculties, he writes this piece of Non-sense.

4. Fourthly,

4. *Fourthly*, Whilst he makes of her a Mechanical Engine, and a Tool of the Matter, he denys her Wheels and Weights, and Springs, and Roaps to pull with.

5. *Lastly*, In assigning her the expulsive Faculties, he gives her an Employment fit for a *Dutch* Doctor's Soul, *viz.* to turn out Excrements, and to wait at the back Door.

And tho' these his Assertions might be denied him, as well as he denys without Proof the Existence of Spirits, and the working of the Soul upon the Parts by their means; and especially because they are contrary to Sense, Reason and Divinity, (this last teaching that the Soul was given to rule over the Body and all its Parts, and to use it as her Tool, and exert her Faculties freely, independently from *the Body of this Death*, *Rom. 7. 24.* and the Clog of those vile Lusts, which raising a Mist or Smoak in her from her Nether-lands, darken and put out her Eyes; but was by no means given *so fulfil the Lusts thereof*, *ch. 13. 14.* tho' the Parts be disposed) yet not to go so far back from the main Point, (*viz.* by what the Soul acts upon the Parts, and makes the Heart expel Blood) as the Office of the Soul in point of Divinity, I will that he may be made sensible of the Wisdom of his *Dutch* Philosophy, answer him accordingly, *Prov. 26. 5.* by reminding him of things were not unpleasing to him, since he is so great a Friend of the Materiality, or so carnally minded, I mean of the stirring, and the ebbing and flowing of that *enlivened* sometimes his Grasshopper in his Youth; and how his Soul was sometimes busy and sometimes remis in exercising that part; and sometimes quite gone from it, whilst *present* and very brisk in every other place; and how, when being absent, she never appear'd again, to perform her Actions there, but when there were new Spirits provided to bring her back: for it is known, that she brought nothing else along with her; And that nothing but Spirits waited upon her thither? and by what, I pray him, doth an Asprick up her Ears, when being faint and weary, ready to give up the Ghost or the rest of her Spirits, for want of what brings her back, *Lament. 1. 11.* they are both flapping about?

Surely,

Surely, if the Soul could work of her self upon the Parts, the Body would never die, but be, like her, Immortal. For she never departing from it but unwillingly, she would abide and harbour in it, and actuate its Parts so long as she lives her self, if she were not obliged and forced to forsake it, with the Spirits her Vehicle, that join her to the Body. The reason of her Absence, or of her ceasing to act, being but because she is an immaterial Substance, and the Body material; and therefore, that the distance and difference between them is such, that she cannot join with it, nor work upon it of her self, without the help of a *Medium* or Mean, to wit, the Vital Spirits, which partake of both Extreame. So that when the Body is deprived of its Spirits, it falls and remains Senseless, and is but a Cadaver, tho' the Soul be within it, *Jam. 2. 26.* as appears by the Palsy, the Numbness and Gangren'd Limbs, which are Dead and Mortified, tho' the Body be living. The Soul remaining in it or by it in her Vehicle, *viz.* the Spirit of the World, which was breathed in with her, *Gen. 2. 7.* without acting and working by its means upon the Parts; because this moves not the Parts but when it becomes Vital. And this is meant of the Soul of natural Men only; for the Souls of the Faithful, which are regenerated, when they die, remain in God, in those *everlasting* Arms which embrace every thing, and lye underneath open and ready to receive her, *Deut. 33. 37.*

I wonder this Man durst pretend to profess Physick, being so ignorant of Nature, and of its Principles, *viz.* Spirits, Heat and Motion! and how the Materialists, who know nothing of Spirits, have the Face to practice it! for its Practice being but *additio. & subtractio* of what gives Health and makes Sick; which is the same thing as that which gives Life, to wit, Spirits: how can they, do it without knowing the things that encrease and diminish Life and Health; and how to add and subtract? In deed, to Purge, and Vomit, and Bleed to Death, and Blister, is of great Efficacy towards the taking from Life that which gives and foment it; whence to be a quick ready *Receptorum Magister*, quick at prescribing Physick, makes now

